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vol 18 no 6 JUNE 61

American Journal of Hospital Pharmacy

official publication of the American Society of Hospital Pharmacists

FORMERLY The BULLETIN

OUR PROFESSIONAL ETHICS

AMSCO equipped Solution Rooms have one "Common Factor"...

they save hospitals thousands of dollars every year

Of the many procedure changes possible in modern hospitals, *none will save more dollars annually* than the conversion to hospital-made solutions.

Hundreds of hospitals . . . seeking to cut costs while maintaining rigidly high standards . . . have turned to Amsco for objective recommendations concerning the proper "Solutions Program" *for their particular needs.*

It is well known that 75% of hospital solutions are used for external or irrigating purposes. The balance of course, are lifesaving parenterals. It's equally well known by hospitals currently benefiting from an Amsco designed and equipped Solution Preparation Room that these same External or Surgical Solutions. . . and many Parenterals . . . *can be made at* <u>*one-quarter*</u> the cost of commercial solutions.

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- **They produce their own External Solutions and many Parenterals in an Amsco equipped Solution Preparation Room located in the Central Service Department or Pharmacy. Critical Electrolyte Solutions, Blood Transfusing Plastic Bags, Bottles and Sets, and Disposable Solution Administration Sets are purchased from AMSCO LABORATORIES . . . a division of the American Sterilizer Company.**
- **Others produce only External Solutions . . . depending upon AMSCO LABORATORIES for <u>all</u> their Parenterals, Disposable Sets, etc.**

Why not ask your Amsco man to discuss an OBJECTIVE, correctly-balanced "Solution Program" for *your* hospital? It will be based *solely* on the specific solution needs, available floor space and your existing equipment. The results of our studied recommendations will involve minimum capital investment . . . and a significant decrease in your annual solutions costs.

Write for our 32-page brochure "Sterile Fluids for the Hospital"— MC-513.

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American Journal of Hospital Pharmacy

American Society of Hospital Pharmacists

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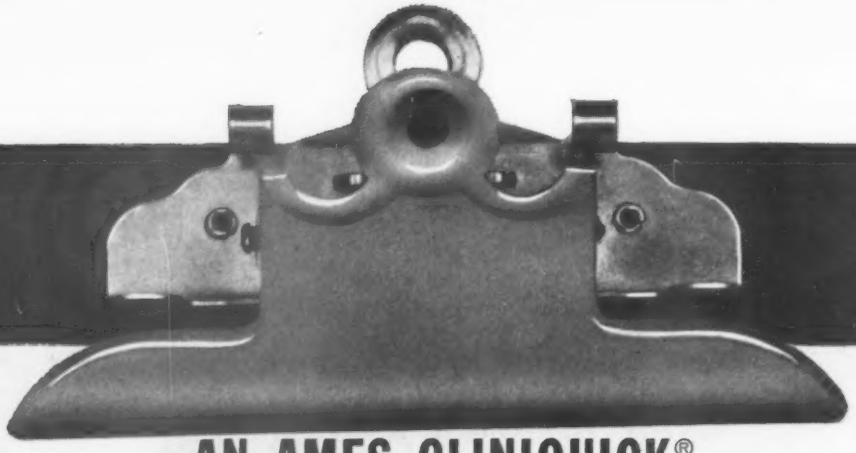

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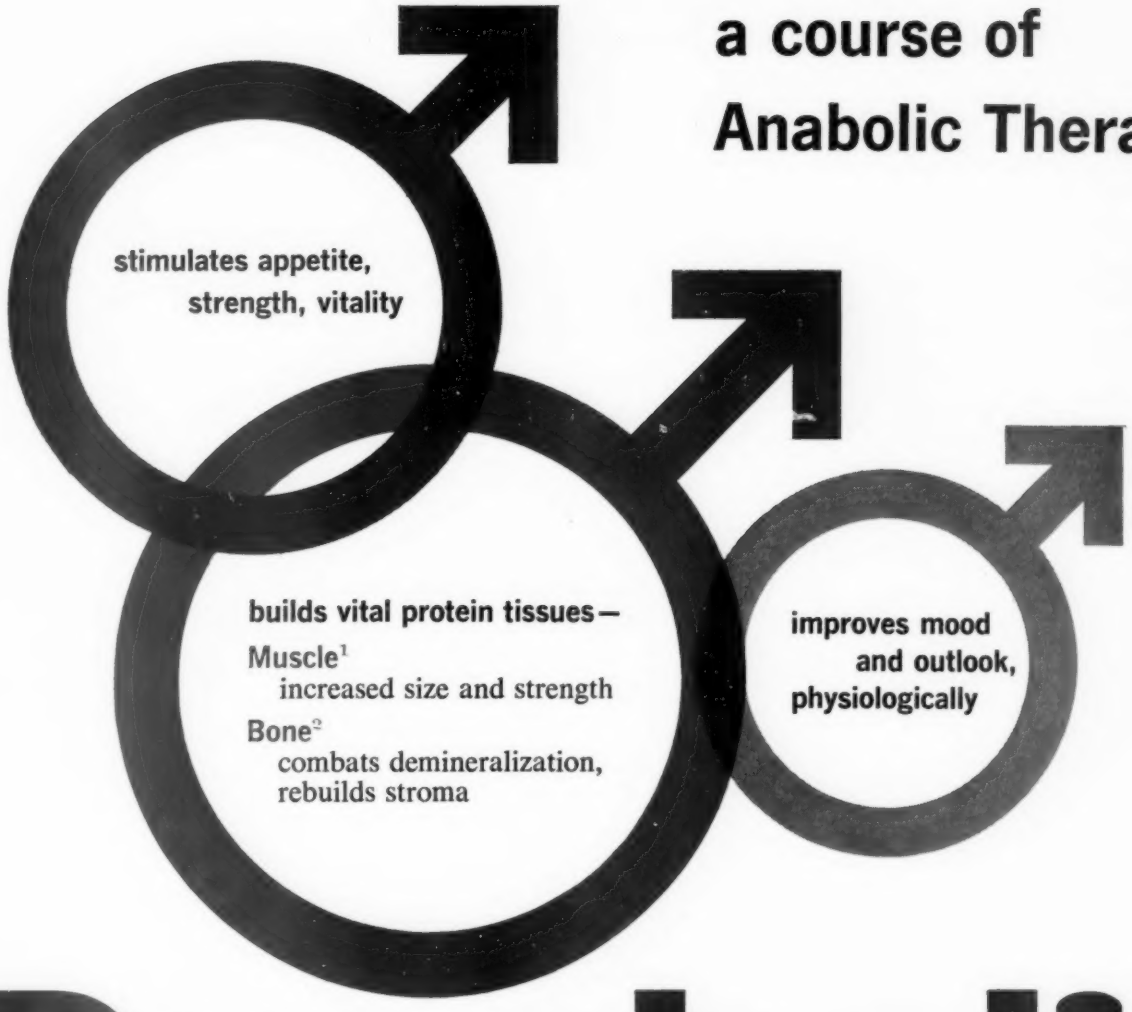

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to improve mood and outlook; restore appetite strength and vitality; relieve pain; stimulate gain in solid muscular weight; hasten recovery. Your patient *feels* better because he *is* better.

Indications: anorexia, chronic fatigue and post-viral debility, osteoporosis, mammary cancer, pre- and post-surgery, severe burns and trauma, and other catabolic conditions. **Dosage:** Adults: 50 mg., i.m.; then 25 to 50 mg., i.m., weekly for twelve weeks. Children: 2-13 years—25 mg., i.m., every 2 to 4 weeks. Infants: half children's dose. **Supplied:** DURABOLIN (25 mg. nandrolone phenpropionate/cc.) in 5-cc. vials and 1-cc. ampuls (box of 3). **New Durabolin-50** (50 mg. nandrolone phenpropionate/cc.) in 2-cc. vials.

1. Osol, A. and Farrar, G. E., Jr.: The Dispensatory of the U.S.A., ed. 25, J. B. Lippincott, Philadelphia, 1955, p. 1392.
2. Best, C. H. and Taylor, N. B.: The Physiologic Basis of Medical Practice, ed. 7, The Williams and Wilkins Co., Baltimore, 1961, p. 1104.

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PASNA TRI-PACK 300 and 600 Pasna Tri-Pak 300: Three packs per day supply 300 mg. isoniazid and 30 mg. pyridoxine HCl in 15 grams Pasna Granules. Pasna Tri-Pack 600, for the patient requiring high INH therapy: Three packs per day supply 600 mg. isoniazid and 60 mg. pyridoxine HCl in 15 grams Pasna Granules.

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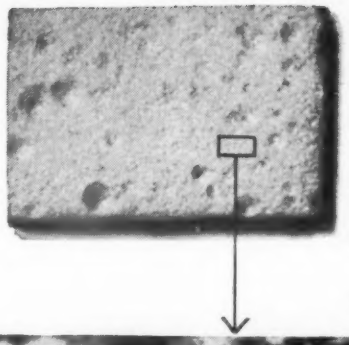
THERAPAS For those patients who cannot normally tolerate PAS, Therapas provides an excellent source of PAS acid in that it rarely causes nausea, vomiting, or any other gastro-intestinal side effects. Therapas is a powder that mixes well with fruit juice, water, milk, or other drinks without changing their taste.

Therapas (calcium 4-benzamidosalicylate) is the calcium salt of 4-benzamidosalicylic acid (B-PAS).

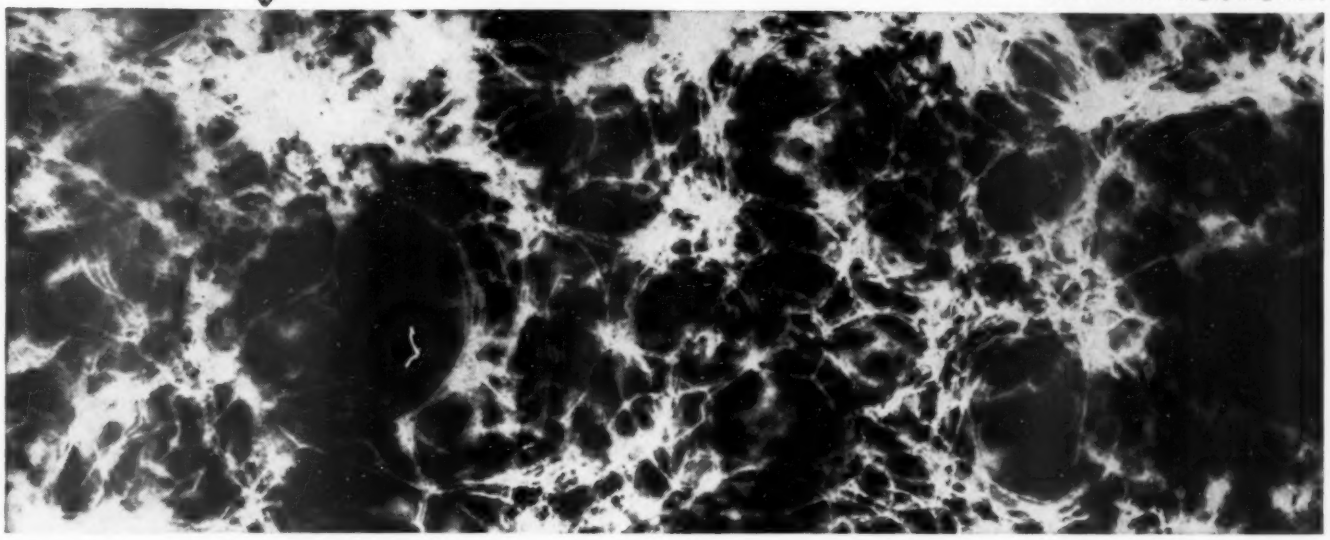
Hospital pharmacists are invited to send for samples to present to staff physicians who are likely to be interested.

Detailed literature is available from the ● **BARNES-HIND PASNA CO.,** 895 KIFER ROAD, SUNNYVALE, CALIFORNIA



here blood enters . . . stops . . . clots . . .

Cross section of Gelfoam (highly magnified)



Hemostasis with Gelfoam sponge is efficient and direct: blood enters . . . stops . . . clots. Later, Gelfoam is absorbed *in situ* with virtually no cellular reaction.

Hospital applications for Gelfoam are many—so varied that one or more of its uses may occasionally be overlooked.

So that your hospital can take full advantage of Gelfoam versatility, make certain you have the right Gelfoam on hand for every use. Gelfoam is supplied as sterile surgical sponge, dental pack, prostatectomy cone, biopsy sponge, sterile powder, and Gelfilm* for neurosurgery and ophthalmologic procedures.

Indications and effects: Gelfoam is an absorbable hemostatic material useful in many fields of surgery. With it, capillary oozing or bleeding from veins may be controlled instantly. When implanted in tissues, Gelfoam is completely absorbed in 4 to 6 weeks without inducing excessive scar tissue formation; when applied to bleeding skin or mucosa, it liquefies in 2 to 5 days.

Administration: Using aseptic measures, Gelfoam is cut to the desired size and applied either dry or saturated with isotonic salt solution or with thrombin solution. The prepared Gelfoam is applied to the bleeding point and held there for ten or fifteen seconds. When bleeding is controlled, the Gelfoam is left in place.

Storage and handling: Gelfoam may be stored indefinitely in the unopened package. After opening, unused portions should be discarded or resterilized by dry-air heating for four hours at 290° F. (143° C.). Sterilization by autoclaving cannot be employed.

*Trademark, Reg. U. S. Pat. Off.

Precautions:
Gelfoam should be used discriminately in arterial bleeding because of the intra-arterial pressure. It is advisable to suture and reinforce where possible.
Do not rely solely on Gelfoam in patients with hemorrhagic dyscrasias.
Gelfoam will not stop menstrual bleeding—do not use post partum or for menorrhagia.
Be sure Gelfoam is in snug contact with all of the underlying or involved surfaces.
Use Gelfoam as sparingly as possible in observation of the surgical dictum regarding "as little foreign material as possible in wounds."
Do not overfill cavities.
Be sure that all air bubbles are expressed from the Gelfoam to discourage possible growth of aerobic organisms.
Do not use in grossly contaminated wounds — the Gelfoam may liquefy too rapidly.
Avoid prolonged exposure of Gelfoam to contaminated air.

some of the capabilities of

Gelfoam* and Gelfilm*

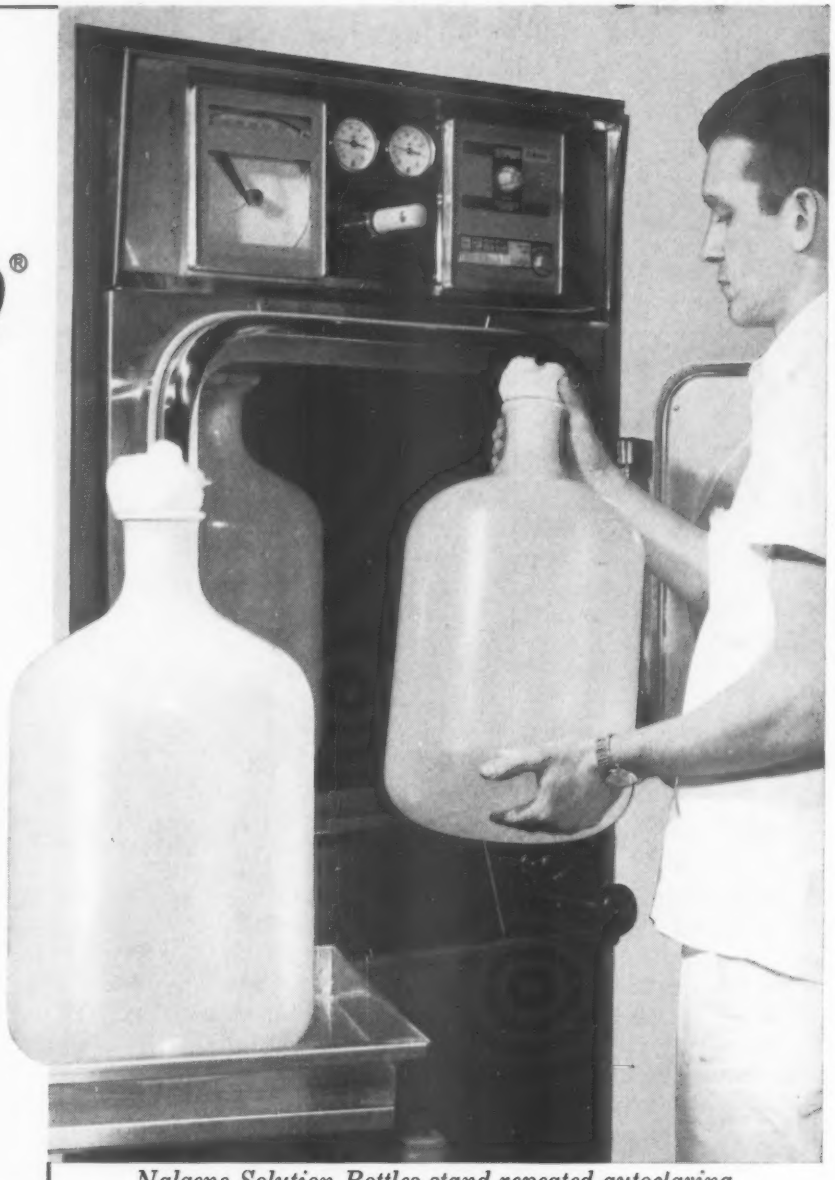
Upjohn 73rd year

- control bleeding from small arterioles
- control capillary ooze
- repair veins
- seal cerebrospinal fluid leaks
- obliterate dead space
- secure a dry operative field
- protect brain surfaces during retraction
- carry medication
- stop epistaxis
- patch small air leaks in reinflated lungs
- reinforce suture lines
- treat gastroduodenal hemorrhage
- facilitate closure and healing of large kidney wounds
- control hemorrhage following anorectal surgery
- control bleeding and oozing in bone surgery
- promote healing in skin ulcers
- serve as biopsy sponge

The Upjohn Company
Kalamazoo, Michigan

New *Nalgene*® 5-gallon Solution Bottle

one-fifth the weight of glass ...and infinitely safer!



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SAFEST EVERY WAY! Blow-molded of virgin polypropylene—all the corrosion resistance of glass, in the most punishment-proof bottle you've ever seen! Drop it empty: it just bounces. Drop it full: it *may* crack, *can't* shatter.

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EASIEST TO HANDLE! Weighs only 2½ pounds (versus 11 pounds for glass). And wet or dry, it never gets slippery like glass. Next time you order, specify Nalgene—and see how much easier these new solution bottles are on you . . . and on your budget. Just check with your laboratory supply dealer.

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Nalge makes them unbreakable and keeps making them better!

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Memo to Hospital Pharmacists

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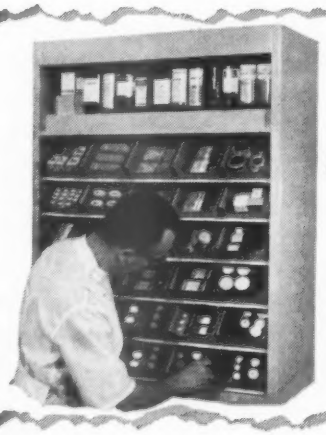
As illustrated above: McKesson COMPACT Storage CABINET, #100, is 35" wide, 16" deep, and 30¾" high. It comes with 20 adjustable steel trays with transparent plastic leading edges for greater visibility. This space-economizer can be used as a wall hanging unit or part of a complete installation. A floor standing combination consisting of two COMPACT CABINETS—one with a finished top, the other (#110) a center section, and a base (#120) with drawers 35" wide, 16" deep, and 22½" high—provides a space-saving 82¼" high unit.



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stores four times more in the same space!

AS ILLUSTRATED: Wall assembly MAGAZINE DISPENSER comes with 30 fiberglass-reinforced plastic trays. The cabinet is 35" wide, 16" deep, and 47¼" high. A CUPBOARD BASE with one adjustable shelf is also available—together they provide a complete unit 35" wide, 16" deep and 82¼" high.

McKesson MAGAZINE *Space Saver* DISPENSER with its gravity feed, inclined trays, gives you control of four times the usual number of fast-moving, prepackaged pharmaceuticals. Easily movable partitions, a variety of trays and a step shelf at the top permit storage of a wide range of sizes and shapes.

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you can't prescribe a more effective antibiotic than ERYTHROCIN®

Erythromycin, Abbott

How much "spectrum" do you need in treating an infection? Clearly, you want an antibiotic that will show the greatest activity against the offending organism, *and the least activity against non-pathogenic gastro-intestinal flora.*

Weigh these criteria—and make this comparison—when treating your next coccal infection. Erythrocin is a medium-spectrum antibiotic, notably effective against gram-positive organisms. In this it comes close to being a "specific" for coccal infections—*which means it is delivering a high degree of activity against the majority of common infection-producing bacteria.*

And against many of the troublesome "staph" strains—a group which shows increasing resistance to penicillin and certain other antibiotics—Erythrocin continues to provide bactericidal activity. Yet, as potent as Erythrocin is, *it rarely has a disturbing effect on normal gastro-intestinal flora.* Comes in easy-to-swallow Filmtabs®, 100 and 250 mg.

Usual adult dose is 250 mg. every six hours. Children, in proportion to age and weight. Won't you try Erythrocin?

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this is where coughs begin...

this is where coughs often end!

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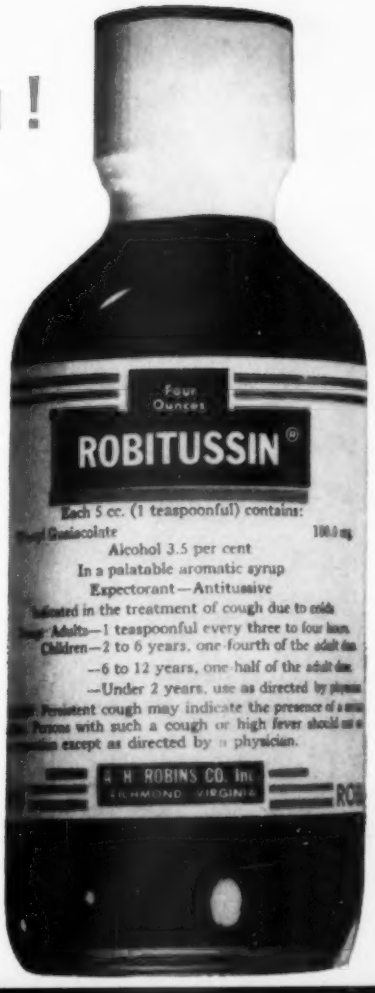
*Cass, L. J., and Frederik, W. S., Am. Pract. Dig. Treat., 2:844, 1951.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In a palatable aromatic syrup
Expectorant—Antitussive
Adults—1 teaspoonful every three to four hours
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JANUARY 1961 · S-80

5-year study[1] with COUMADIN demonstrates: long-term anticoagulation in office management of outpatients is practical and effective

A 5-year study[1] of long-term anticoagulation with COUMADIN (warfarin sodium) in office practice patients has demonstrated that such treatment reduces the probability of further infarctions in the postinfarct patient and is effective in preventing a first infarction in patients with angina.

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"The most significant advantage is the great ease in maintaining patients in a therapeutic range. It has been rewarding to find, month after month, patients varying no more than three or four seconds in their prothrombin times on their established dosage of Warfarin sodium [COUMADIN]."[1]

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FOR ORAL, INTRAVENOUS OR INTRAMUSCULAR USE

the original and only warfarin responsible for establishing this drug as closely approaching the ideal anticoagulant[3,4] and as "the best anticoagulant available today."[5] Over 179,000,000 doses administered to date.

the proven anticoagulant for long-term maintenance

Full range of oral and parenteral dosage forms—COUMADIN* (warfarin sodium) is available as: Scored tablets—2 mg., lavender; 5 mg., peach; 7½ mg., yellow; 10 mg., white; 25 mg., red. Single Injection Units—one vial, 50 mg., and one 2 cc. ampul Water for Injection; one vial, 75 mg., and one 3 cc. ampul Water for Injection.

Average Dose: Initial, 40-60 mg. For elderly and/or debilitated patients, 20-30 mg. Maintenance, 5-10 mg. daily, or as indicated by prothrombin time determinations.

1. Nora, J. J.: M. Times, May, 1961. 2. Nora, J. J.: J.A.M.A. 174:116, Sept. 10, 1960. 3. Baer, S., et al.: J.A.M.A. 167:704, June 7, 1958. 4. Moser, K. M.: Disease-a-Month, Chicago, Yr. Bk. Pub., Mar., 1960, p. 13. 5. Meyer, O. O.: Postgrad. Med. 24:110, Aug., 1958.

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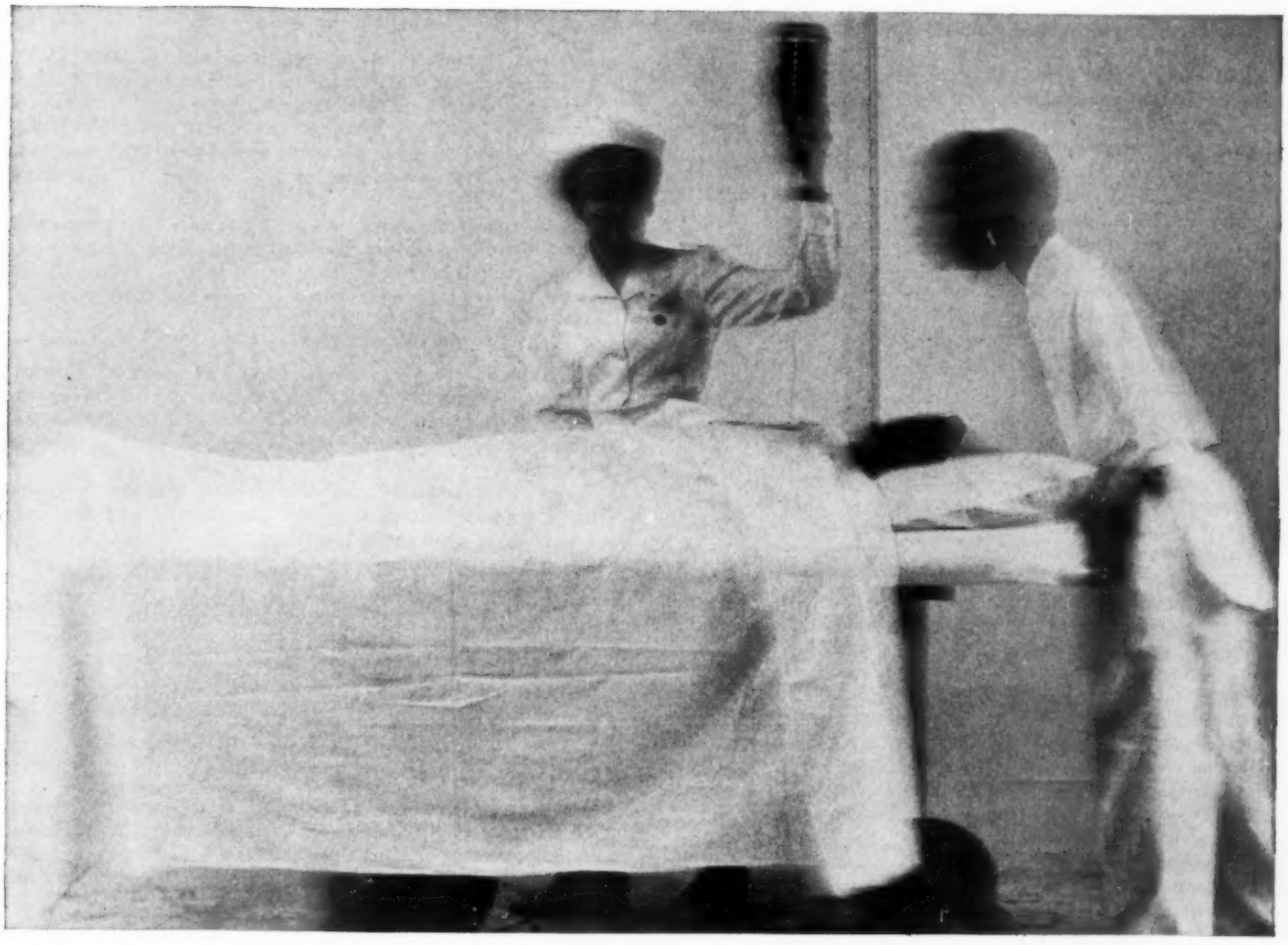
when standard antishock measures fail



Indications and effects: Solu-Cortef is indicated when intense corticosteroid effect is necessary in various situations including acute adrenal cortical insufficiency, bilateral adrenalectomy, shock unresponsive to standard antishock therapy, acute hypersensitivity reactions, disseminated lupus erythematosus in relapse, and overwhelming infections with severe toxicity. *Administration and dosage:* Sterile Solu-Cortef may be administered intravenously or intramuscularly, the intravenous route being preferred in emergencies. The initial dose is 100 mg. or 250 mg., depending on the severity of the condition, injected over a period of one-half to one minute. This dose may be repeated at intervals of one, three, six and ten hours, depending on the response and clinical condition.

Precautions and contraindications: Careful management is required, especially during sustained therapy, to guard against untoward manifestations such as sodium retention, edema, excessive potassium loss, and negative nitrogen balance. Solu-Cortef is contraindicated (except for emergency replacement therapy in acute adrenal cortical insufficiency) in patients with tuberculosis, herpes simplex keratitis, chronic nephritis, acute psychosis, Cushing's syndrome, peptic ulcer, and predisposition to thrombophlebitis. Existence of congestive heart failure, hypertension, diabetes, osteoporosis, or chronic psychiatric disorders requires that Solu-Cortef be administered with extreme caution. In the presence of infection, the causative organism must be brought under control with appropriate antibiotics; otherwise Solu-Cortef should be discontinued.

Supplied: In 2 cc. Mix-O-Vial* containing 250 mg. or 100 mg. hydrocortisone (as hydrocortisone sodium succinate), and in 10 cc. vial containing 100 mg. hydrocortisone (as hydrocortisone sodium succinate) per vial.

100 mg. (plain vial)
Each vial contains:

Hydrocortisone (as hydrocortisone sodium succinate)	100 mg.
Sodium biphosphate	0.8 mg.
Sodium phosphate, exsiccated	8.73 mg.

Also available in carton with one 2 cc. ampoule injectable sterile water.

250 mg. Mix-O-Vial
Each Mix-O-Vial contains:

Hydrocortisone (as hydrocortisone sodium succinate)	250 mg.
Sodium biphosphate	2 mg.
Sodium phosphate, exsiccated	21.83 mg.
Methylparaben	2.34 mg.
Propylparaben	0.27 mg.
Water for Injection	1.8 cc.

100 mg. Mix-O-Vial
Each Mix-O-Vial contains:

Hydrocortisone (as hydrocortisone sodium succinate)	100 mg.
Sodium biphosphate	0.8 mg.
Sodium phosphate, exsiccated	8.73 mg.
Methylparaben	2.34 mg.
Propylparaben	0.27 mg.
Water for Injection	1.8 cc.

In shock resulting from trauma, surgery, or overwhelming infection, Solu-Cortef* triggers vasopressor effects. As a result, patients often respond to Solu-Cortef when standard antishock measures have failed.

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Southeastern Society

Howard Clem, Langdale, Alabama, became president of the Southeastern Society of Hospital Pharmacists at its Annual Meeting in Memphis, April 21-23, 1961. Other officers installed at the business session were: Owen Crutcher, Johnson City, Tenn., vice-president; and Mary Wernersbach, Miami, Fla., secretary-treasurer.

Mr. Clem has been chief pharmacist of the George H. Lanier Memorial Hospital, Langdale, Alabama, since its opening in 1948. Also nominated for next year's officers were: *For president*: Allan Ford, Jacksonville, Fla., and Lewis Bevis of Tallahassee; *For vice-president*: Kenneth Flinchum, Greenwood, S. C., and Clayton McWhorter, Albany, Ga.; and *For secretary-treasurer*: Mary Lancaster, Gadsden, Ala. These nominees are subject to election by mail ballot this summer, according to Nominating Committee Chairman, Gilbert Colina.

Dean Seldon D. Feurt, of the University of Tennessee's School of Pharmacy at Memphis, was the featured speaker of the meeting. He outlined future plans for three-level hospital pharmacy courses of instruction. Presently, he said, Tennessee has a compulsory undergraduate hospital course, a master's course, and in the future hopes to offer a doctor of philosophy degree which he says is needed primarily to develop professors for the colleges of pharmacy. In a word to the entire profession, Feurt pointed out that the 30 percent of drugs now being dispensed through the hospital pharmacy has never been dispensed through the local drug store channels and therefore do not represent "business" that has been taken from the retailer.

Dr. William Heller, director of pharmacy service at the University of Arkansas Medical Center and director of the *American Hospital Formulary Service*, spoke, giving eight fundamental reasons for the use of the *Formulary Service*.

Bill Djerf of Methodist Hospital, Memphis, moderated a panel on hospital pharmacy problems and Perry Cox, outgoing SSHP President, appeared on a panel of the Hospital Conference on Management, which was moderated by Hospital Consultant Everett Jones. This was conducted as part of the Convention of the Southeastern Hospital Association's Convention.

The Southeastern Society will hold its next annual meeting April 25-27, 1962, in New Orleans.

Southern California Society

Members of the Southern California Society of Hospital Pharmacists met at the Hollywood Presbyterian Hospital in Los Angeles on March 8. The program was presented by Mr. Hugh E. Gillis, director of first aid, Los Angeles Chapter of the American Red Cross, who presented the film "That They May Live." This film illustrates mouth to mouth resuscitation in various emergency situations.

Business transacted during the meeting included routine reports, introduction of guests, plans for future meetings and the annual seminar, information regarding bills before legislature, and appointment of delegate to the Annual Meeting of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS.

Colorado Society

The regular meeting of the Colorado Society of Hospital Pharmacists was held Wednesday, March 15 at 7:30 p.m. at Veterans Hospital in Denver. Twenty-three members and guests were present. The meeting was called to order by President Irvin Friesen.

Mr. Charles J. Hlad, Jr., chief of the Research Laboratory and assistant director of the Radioisotopes Service at the Veterans Administration Hospital, presently an interesting program.

Business transacted included routine reports. Mrs. Helen Angel reported on the Career Day participation and Student Visitations; Dr. H. Mehta reported that the University of Colorado is holding Saturday meetings for high school students who want to know more about the University; and Mr. Herbert Carlin reported on the Seminar to be held on April 7 and 8.

Following presentation of a communication concerning Project HOPE, members were urged to make contributions through the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS and the Colorado Society voted to make a contribution.

Connecticut Society

Members of the Connecticut Society of Hospital Pharmacists met for their Annual Meeting on April 19 at the Wonder Bar Restaurant in Berlin, Connecticut. The dinner was sponsored by Schering Corporation with 31 persons in attendance.

Business transacted during the meeting included a discussion of proposed changes in the Constitution and By-Laws, a report from the Nominating Committee for officers for the 1961-1962 term, and a discussion with regard to future plans for meetings.

A film entitled "Rx Caution," was included on the program. Shown by Mr. Herman Weisman, Schering representative, the film presented a look at two types of pharmaceutical plants and their manufacturing and quality control facilities. The film was produced by the New Jersey State Department of Health.

Louisiana Society

Members of the Louisiana Society of Hospital Pharmacists held a one day meeting in conjunction with the Louisiana Hospital Association's thirty-sixth Annual Convention, Saturday, February 25, at the Captain Shreve Hotel in Shreveport.

Miss Gladys Hebert, L.S.H.P. president, welcomed guests at the 9:30 a.m. session, outlining the Society's plans to hold meetings in cities other than the New Orleans area from time to time. A panel discussion on "Prescription Pricing," was led by Mr. Troy Carter, V. A. Hospital, New Orleans. He was assisted by Miss Frances Pizzolato, Touro Infirmary, New Orleans, Mr. Malcolm Claus, Baptist Hospital, New Orleans and Mr. Herbert Mang, Oschner Foundation Hospital, New Orleans. An informative discussion followed as pharmacists from different parts of the state explained their pricing schedules.

At noon the meeting was adjourned and the guests attended the luncheon and installation of officers of the Louisiana Hospital Association.

The afternoon session was devoted to "New Anesthetics, Analgesics and Hypnotics." Dr. John Adriani, chief of the Anesthesia Department and Blood Bank, Charity Hospital, New Orleans, was the guest speaker.

Maryland Association

The Maryland Association of Hospital Pharmacists held a "Hospital Pharmacy Symposium" on Saturday, April 15 at Maria's "300" Restaurant in Baltimore. A unique arrangement as an admission charge consisted of one copy of an old pharmaceutical reference book to be donated to Project

CONTINUED ON PAGE 18

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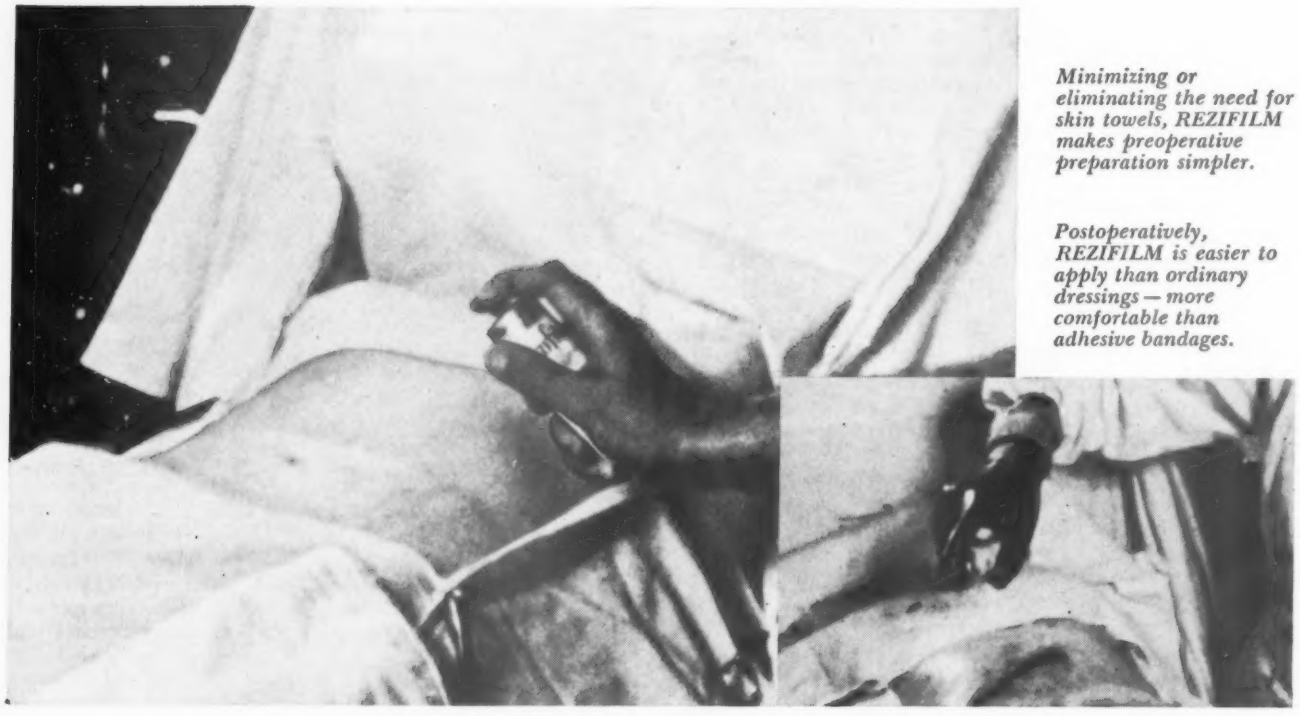

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References: 1. Eisenberg, G. M., Weiss, W., Spivack, A. P. and Flippin, H. F.: *Antibiotic Med. & Clin. Ther.*, **6**:594 (1959). 2. Thomson, J. E. M.: Clinical Research Notes, Vol. 3, #3, p. 1 (1960). 3. Kanof, N. B., and Blau, S.: *Arch. Dermatol.* **83**:503 (1961). 4. Bronwell, A. W.: Clinical Research Notes, Vol. 3, #3, p. 6 (1960).

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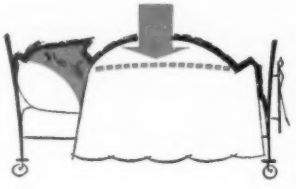

In 42 postsurgical patients . . . "Ilopan was responsible for a 50% reduction in number of enemas, and a reduction or earlier withdrawal of catheters and Levin or Cantor tubes. In 213 additional surgical procedures . . . patients on Ilopan . . . an 86% effective improvement"

Kareha, L. G., et al, W. Jour. S.G. & O., 66:220, 1958

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Stone, M.L., et al, Amer. J. Surgery, 97:191, 1959

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On behalf of the Maryland Association of Hospital Pharmacists, Mr. Robert A. Statler presents pharmaceutical references and texts to Mr. Nicholas Craw, Director of Logistics, Project HOPE.

HOPE. It was indicated that the countries visited by the U. S. HOPE Hospital Ship are in desperate need of any and all reference texts. These books will be sent to Project HOPE as a special activity of the Maryland Association.

A highlight of the Symposium was a film entitled "Monganga" taking place in Lotumbe, a remote native village in the Belgian Congo. The film describes the activities of a medical missionary, Dr. John Ross. Another speaker was Mr. George White, regional manager of Lederle Laboratories, Division of American Cyanamid Co., Washington, D. C.

A panel discussion on "Pharmacy Service and Central Sterile Supply," discussed the inter-relationship of a combined pharmacy and central sterile supply service bringing out inherent and potential advantages and disadvantages, either combining or not combining the two services.

Subjects and discussions were as follows:

"A Hospital Pharmacist's Point of View"—Milton W. Skolaut, director pharmacy service, Clinical Center, National Institutes of Health, Bethesda, Maryland.

"A Nurse's Point of View"—Mrs. Martha Thomlinson, R. N., superintendent, Central Sterile Supply, The Johns Hopkins Hospital, Baltimore.

"An Administrator's Point of View"—Edward H. Noroian, Ph.D., director, Administrative Research and Development, University Hospital, University of Maryland, Baltimore.

The meeting closed with a spaghetti dinner sponsored by Lederle Laboratories.

Massachusetts Society

"What the Hospital Pharmacist Should Know About the Narcotic Laws," was the subject presented at the March 22 meeting of the Massachusetts Society of Hospital Pharmacists. The speaker was Mr. Theodore J. Walker. Following a dinner sponsored by Lederle Laboratories, the meeting was called to order by President John Webb. Routine reports, including those of the Legislative Committee, the Employment Committee, the Membership Committee and the New England Hospital Pharmacy Council, were presented. The meeting was held at the Massachusetts General Hospital in Boston.

Michigan Society

Members of the Michigan Society of Hospital Pharmacists met at University Hospital in Ann Arbor on Thursday, April 13. The principal speaker was Mr. Roger E. Wyatt, Jr., of the Michigan State Board of Pharmacy.

Business included nominations for officers for the 1961-1962 term and announcements regarding future meetings.

Minnesota Chapter

The Minnesota Chapter of the American Society of Hospital Pharmacists met at Veterans Hospital in Minneapolis on April 4, 1961. The meeting was called to order at 8:20 p.m. by the president, William H. Strohbeck, chief, Pharmacy Service, Veterans Hospital.

The guest speaker for the evening, Mr. Ray Bowman of Lederle Laboratories, Minneapolis, was introduced. His topic was "The Doctor Is Listening." He was assisted by Phil Smith, also of Lederle. The Pharmacists' Professional Service Clinic, the source of Mr. Bowman's subject material, has been conducted annually by Lederle at the national conventions of the National Association of Retail Druggists. It gives pharmacists the opportunity to practice their telephone presentations of information about prescription drugs to physicians. This report covers 921 conversations made at the 1956, 1957, 1958 and 1959 clinics. Mr. Bowman's presentation was interesting and served to increase our awareness of the need to keep well informed on current drug therapy.

A business session followed. Mr. Strohbeck and members present gave a vote of thanks to the outgoing officers, giving particular mention to the excellent service rendered last August during the Institute on Hospital Pharmacy held at the University. He also thanked members for their fruitful efforts in establishing the Pharmacy Section of the annual Upper Midwest Hospital Conference. Mr. Strohbeck announced that Ray Johnson, chief, Pharmacy Service at Glenwood Hills in Minneapolis, has accepted the chairmanship of the membership committee. He will be assisted in Minneapolis by Joe Sing, also of Glenwood Hills, and in St. Paul by Henry Capiz, chief, Pharmacy Service at St. Lukes.

Greater Kansas City Society

The Society of Hospital Pharmacists of Greater Kansas City met in the Conference Room at the Blue Cross-Blue Shield Building on Wednesday, March 8 at 2:30 p.m. The meeting was called to order by President W. F. Wilhelm with eleven members present. Following routine reports, the President reported on action taken at a joint pharmacy meeting on February 9 for the purpose of petitioning for a local Branch of the American Pharmaceutical Association in Greater Kansas City.

On announcing plans for the Health Fair scheduled for March 18-26, President Wilhelm outlined the aims of the Fair as follows:

1. Educate the public in matters of health care.
2. Stimulate in young people an interest in medical and related vocations.
3. Improve the public's opinion of medicine.

The program for the Mid-West Hospital Convention was discussed. The aim this year is to have all participants on the Convention program from outside the Kansas City area. However, because of over-lapping Convention dates with the A.Ph.A. Convention there have been some cancelations and Mr. Wilhelm was asked to preside on one day.

Greater St. Louis Association

The Hospital Pharmacists Association of Greater St. Louis met at St. Mary's Hospital on March 14 with forty-five attending. Business included a report of the Special Projects' committee in which Mr. Raymond Dye suggested printing and making available information about poison control in the St. Louis area. Following discussion, it was agreed that the material would be prepared and made available at the May meeting which was to be devoted to the subject of poison control.

Other discussions covered items of special importance with regard to inspection of the pharmacy department by the Joint Commission on Accreditation of Hospitals and a discussion of the *Statement of Guiding Principles on the Operation of the Hospital Formulary System in Hospitals* as printed

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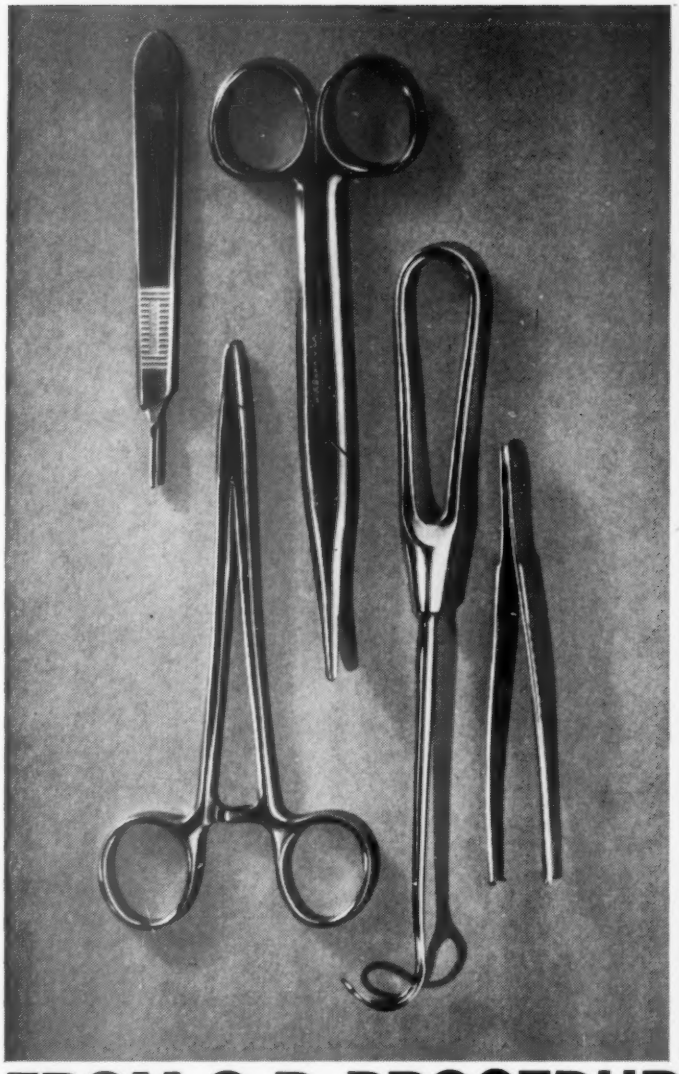

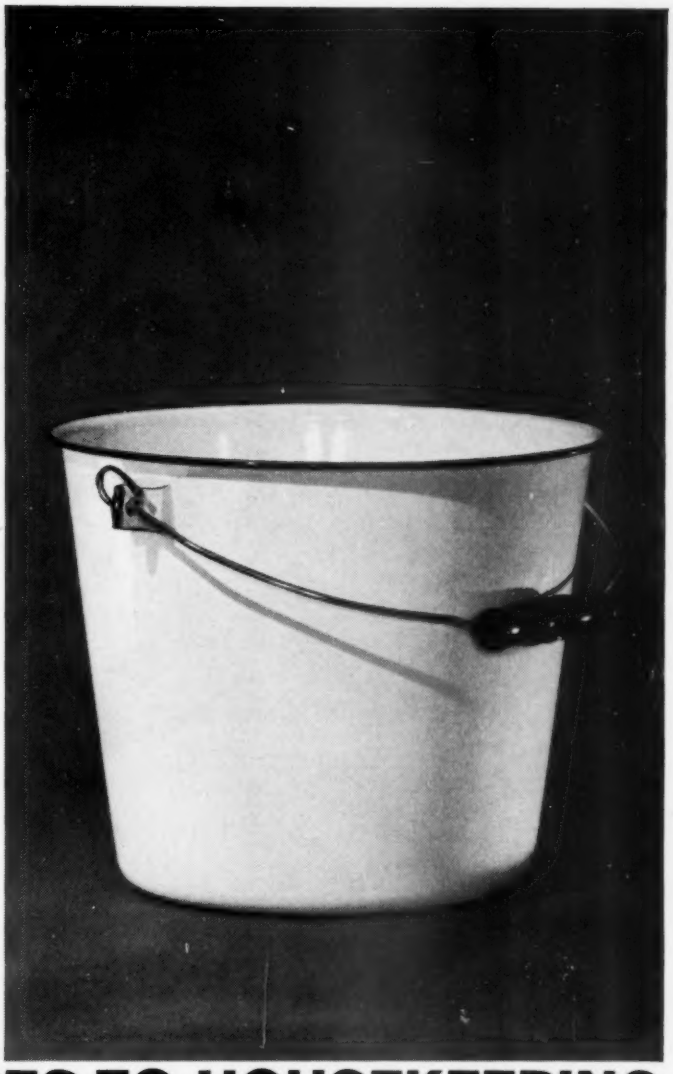

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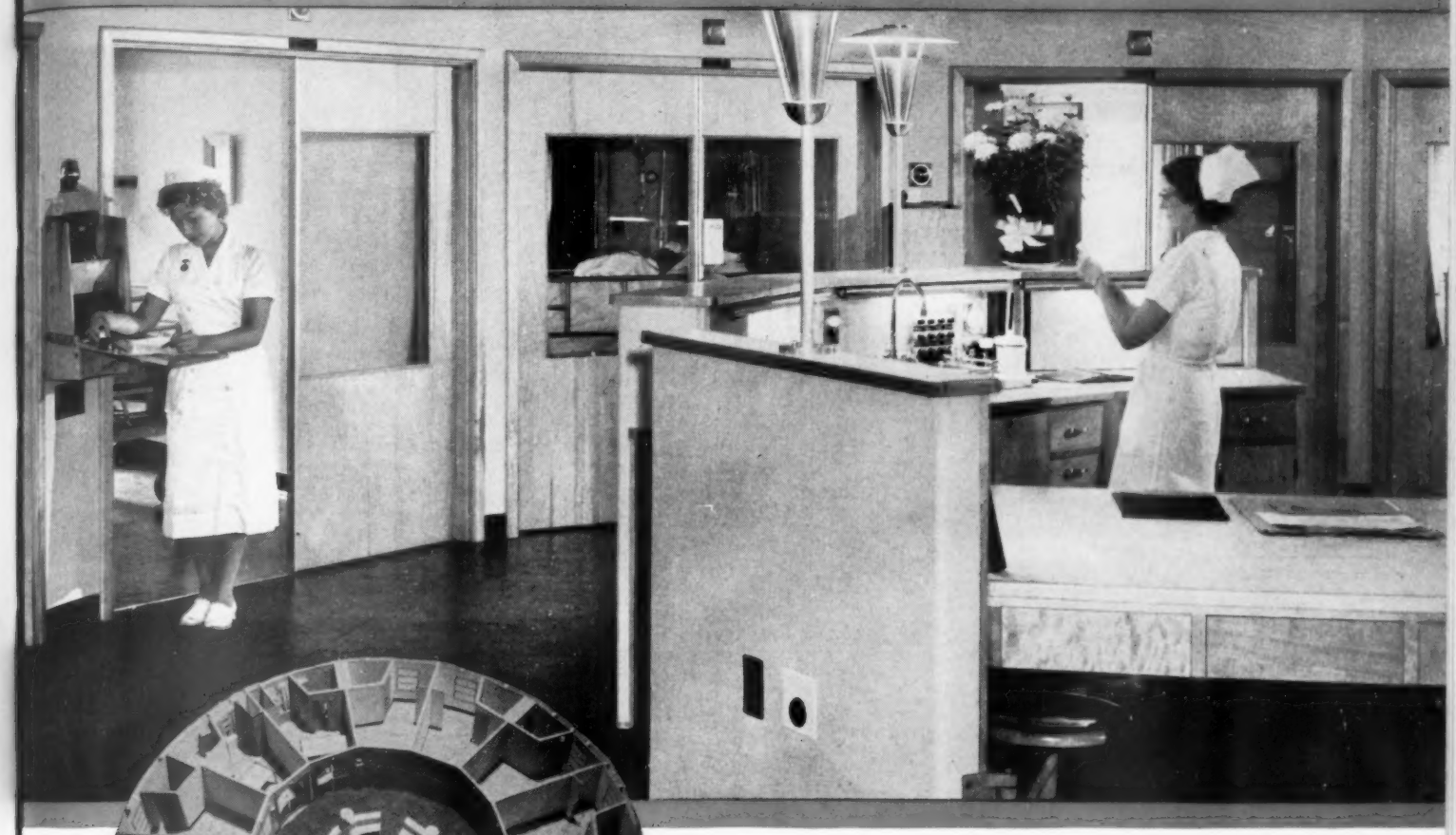

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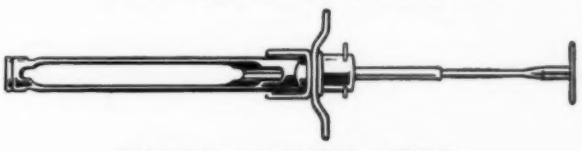

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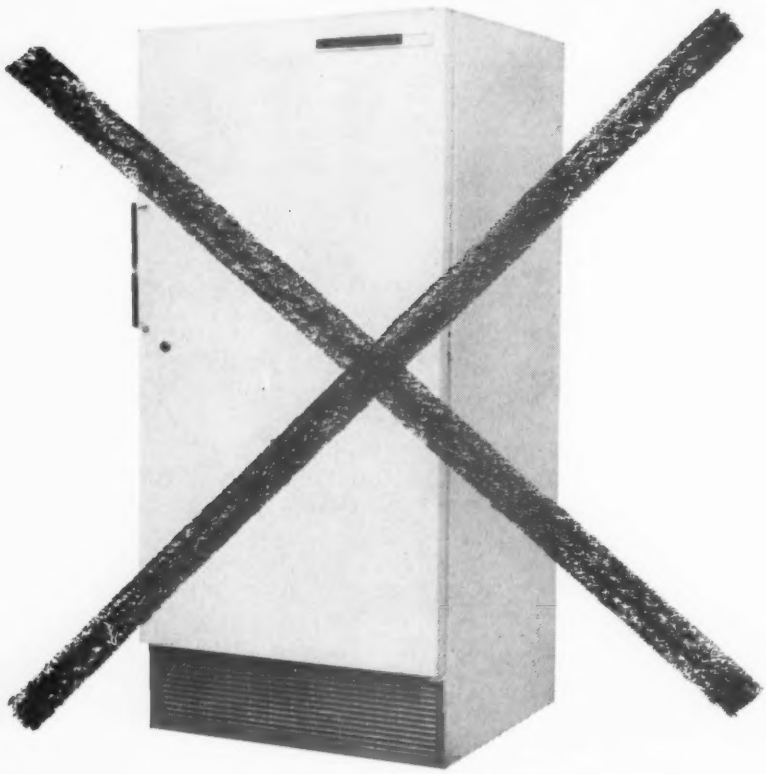

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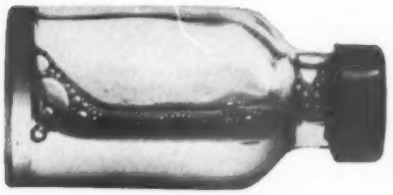

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in recent issues of both *Hospitals* and the JOURNAL OF THE AMERICAN SOCIETY OF HOSPITAL PHARMACISTS. Pharmacists present agreed that items of particular importance were concerned wih the fact that quality of a drug comes first in purchasing and the pharmacist must retain control of the purchase of drugs. Further points with regard to the determination of quality were outlined.

Announcements included report of a release on Mr. Herbert Flack as the 1961 recipient of the Harvey A. K. Whitney Lecture Award. Sister Mary David, assistant chief pharmacist at St. Mary's Hospital was chosen as the delegate to the 1961 Annual Meeting of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS. Sister Marie Stella was chosen as alternate.

The May meeting of the Hospital Pharmacists Association of Greater St. Louis was scheduled for Tuesday, May 9 at the Homer G. Phillips Hospital. Highlight of the meeting was to be a presentation on poison control with a series of slides made available through Wyeth Laboratories, Inc. and the American Pharmaceutical Association.

Members of the Greater St. Louis Society recently received a directory of members of the Hospital Pharmacists Association of Greater St. Louis.

New Jersey Society

The regular meeting of the New Jersey Society of Hospital Pharmacists was held on April 20 at the Hospital Center in Orange. Following dinner, the meeting was called to order by Vice-President Henry Roche. During the business session, plans were outlined for the May 4 Institute on Hospital Pharmacy which is being sponsored by the New Jersey Society. The Institute is open to administrators, chairmen of pharmacy committees, and directors of nursing, as well as hospital pharmacists. Other business included a report from the treasurer, announcements regarding future meetings and special activities, and discussions concerning membership.

New officers elected to serve the New Jersey Society during the coming year include *President* Henry Roche, *Vice-President* Joyce Dolecki, *Treasurer* Victor Ern, and *Secretary* Regina Richards.

Northeastern New York Society

The Northeastern New York Society of Hospital Pharmacists held a joint meeting with the Medical Service Representatives of the Capital District at St. Clare's Hospital in Schenectady on Tuesday, April 18. After greetings from Sister Mary Martin, S.E.P., assistant administrator at the hospital, Mr. Daniel Behan, chief pharmacist, and Mr. William McKimmie, president of the medical service representatives, a panel discussion was held on the responsibilities of the medical service representative toward the hospital pharmacist, and the hospital pharmacist toward the medical service representative. Dr. William Graham, director of the Ellis Hospital in Schenectady, moderated the panel which included Mr. David Curley and Mr. Gerald Langhauser from the medical service representatives, and Mr. Walter Markunas and Mr. Francis Mastrianni from the hospital pharmacists.

Mr. Alfred Mannino, manager, Hospital Sales Division of the Geigy Pharmaceutical Company, spoke on the topic "Hospitals and Hospital Pharmacy—1970." Mr. Mannino charged the audience to work as more productive persons and to be responsible to the changes which the fast moving pharmaceutical field demands.

The president announced that Mr. William would be the delegate and Mr. Louis P. Jeffrey would be the alternate delegate to the ASHP Annual Meeting in Chicago the week of April 23. Mr. Hotaling and Mr. Benjamin Teplitsky will be the delegates of the New York State Council of Hospital Pharmacists at the luncheon meeting to be held on April 24 at the Chicago Convention.

Western New York Chapter

Members of the Western New York Chapter were guests of McKesson and Robbins, Inc. for a dinner meeting on April 18, at the Sheraton Hotel in Buffalo. Mr. Milton Stomatos, director of the Hospital Division of McKesson, addressed the group briefly after the dinner. The nominating committee reported on its slate of officers for next year. It also reported that this year, for the first time, the Chapter will vote by mail ballot and the new officers will be installed at the May meeting.

On April 19, 1961, the Western New York Chapter held its first annual Student Visitation Program. Under this program, the Chapter, in cooperation with the University of Buffalo College of Pharmacy, conducted visits to the pharmacies of thirteen area hospitals. The junior and senior classes of the College of Pharmacy were divided into small groups and each group was shown the operation of two of the pharmacies. This is to be an annual program and it is felt by members of both the Chapter and the faculty of the College that it will encourage more graduating pharmacists in Western New York to enter the hospital field.

Akron Area Society

Members of the Akron Area Society of Hospital Pharmacists met at Massillon City Hospital on April 11. President Hildah Douglas called the meeting to order with fifteen members present.

Business included a report on public relations by Wayne Eaton, a report on the work of the Committee on Emergency and Disaster by Charles King, and Mrs. Mary Morgan presented a summary of activities in connection with the student project. A report on the recent meeting of the Ohio Society of Hospital Pharmacists which was held in Columbus was presented by Jeanne Sickafoose and Ethel Baran.

New officers of the Akron Area Society elected to serve during the coming year included *President* Ethel Baran, *Vice-President* Wayne Eaton, *Treasurer* Ed Clapp, and *Secretary* Dora Boling.

The program for the meeting included a tour through the Cancer Treatment Center in Massillon. Dr. A. Loeffler explained the various services in the Center and also showed the betatron machine.

Oregon Society

The program for the March 8 meeting of the Oregon Society of Hospital Pharmacists included a talk and slides on new product development at Smith Kline and French Laboratories by Dr. Robert Doerge now at the Oregon State College School of Pharmacy. Another highlight of the meeting included presentation of the Geigy Annual Leadership Award to President Richard Neal.

Business transacted during the meeting included reports on the student tour with suggestions for next year. Other business considered included consideration of a bill before legislature providing for a new wing and refurbishing of the old wing of the pharmacy building at Oregon State College and appointment of a nominating committee to serve for next year's election.

Western Pennsylvania Society

The regular monthly meeting of the Western Pennsylvania Society of Hospital Pharmacists was held on April 20 at St. Joseph's Hospital with twenty-four members present. The program included a panel entitled "Current Problems in Ward Stock," with participants including Sister M. Constantia, Henry Derewicz, and William Sinclair.

Another highlight of the meeting included presentation of the Geigy Leadership Award to C. Cleveland and James Sandala. The Award is a gold mortar and pestle with the pestle in the form of a gavel signifying leadership.

Under business, routine reports were received and announcements made.

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References: 1. Gordon, D. M., and Ehrenberg, M. H.: *Am. J. Ophth. 38*:831, 1954. 2. Prangen, A. De H.: *A.M.A. Arch. Ophth. 18*:432, 1937. 3. Ehrlich, L. H.: *New York J. Med. 53*:3015 (Dec. 15) 1953. 4. Miles, P. W.: *Missouri Med. 56*:1243, 1959. 5. Leopold, I. H.: in Abstract of Discussion: *A.M.A. Arch. Ophth. 51*:471 (April) 1954.

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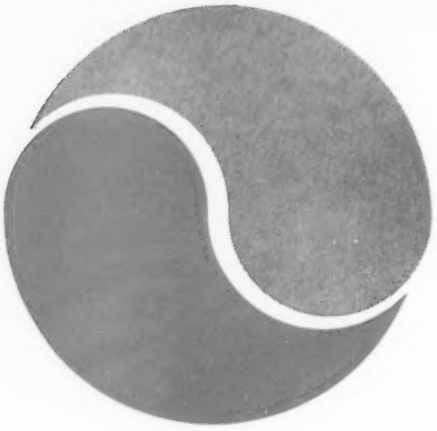

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LAKESIDE

NEW MEMBERS

. . . . . .

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MEMBERSHIP DUES

New Members of the SOCIETY as well as those who are delinquent will want to note the following excerpt taken from the ASHP By-Laws, Chapter V, Article 4:

"The period of membership shall coincide with the period of membership in the American Pharmaceutical Association. Dues are payable and due on the anniversary date of this period. Membership in the SOCIETY and the obligation for dues will continue from year to year unless a member's resignation, signed by the member, is received by the Secretary prior to the end of the year for which dues have been paid.

"Any member in arrears for dues shall cease to be a member of the SOCIETY, provided that at least two weeks before his name is removed from the rolls, the Secretary shall send him a written notice of his delinquency together with a copy of the By-Laws pertaining to the subject. Such a person may be reinstated as a member provided his arrears have been paid and payment of current membership dues is made."

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PROFESSIONAL DIVISION

staph newsletter

TWELFTH OF A SERIES WITH SIGNIFICANT SUGGESTIONS FOR CONTROLLING CROSS INFECTIONS

EVER since the first Staph Newsletter, the "significant suggestions" we have been privileged to offer you on staph control have seldom emphasized the phage types and strains of staph or their varying antibiotic susceptibility. Just as you probably do, we consider any strain of staph potentially dangerous and the judicious use of antibiotics the province of the physicians and the Infection Control Committee. In the March 11th issue of The Journal of the American Medical Association (page 886), Doctors Wallmark and Finland reveal the interesting results of comparing strains of the previous ten years with 1959-1960 at Boston City Hospital. 1550 strains were isolated. Among their significant conclusions are:

The proportion of strains of staphylococci resistant to the widely used antibiotics has continued to increase.

The lowest proportion of resistant strains was obtained from outpatients, the proportion increased with length of hospitalization and was highest in the strains obtained at autopsy.

As sensitive staph strains are eliminated by antibiotics, resistant staph persist, multiply and spread.

Fortunately, there is published evidence that staph organisms which have become resistant to antibiotics do not *ipso facto* become resistant to any one of the L&F phenolic disinfectants—Amphyl®, O-syl®, Lysol®, or Tergisyl® detergent-disinfectant. All are broad spectrum microbicides which are not only staphylocidal but also pseudomonacidal, tuberculocidal and fungicidal. And we do have this suggestion—

Write today for your copy of our new infection control kit titled, "Contamination Control That Works...in your Hospital". In a conveniently index-tabbed jacket we've collected a variety of pertinent materials. Whether you're interested in general housekeeping, isolation units, O.R. and recovery, O.B. and maternity, nursery and pediatrics, emergency and outpatients, laundry, or the whole hospital —you'll find in this kit specific "how, where, and when" information on dependable contamination control. Reprints report successful control of infection in well-known hospitals, and how it is being done. Brochures give specific procedures easy to follow in any hospital. The kit is suitable for use by the Infection Control Committee in re-evaluating environmental control throughout the hospital. We'll be glad to send each member an individual copy if you ask us. Please do.

When you're talking to some of the doctors in your hospital, you may want to tell them about a special clinical symposium, "The Hazards of Infection", scheduled for Sunday, June 25, at the Savoy Hilton Hotel in New York City. This is the final session of the annual meeting of the American College of Angiology and the International College of Angiology which precedes the annual AMA meeting. The complete two-hour program with names and professional affiliations of the participants is too long for mentioning here, but if you would like these details please let us know. Perhaps you, too, will want to be there.

From the time our new spray-on form of Amphyl was first discussed in the L&F research lab, I agreed with many of our hospital friends who felt that Amphyl Spray would take care of a lot of difficult disinfection problems. Particularly—odd-shaped surfaces, hard-to-reach areas, also for immobilizing organisms immediately after accidental spills of infectious material, and prior to disinfection, e.g., by flooding. The versatility of Amphyl Spray as a deodorant is also "inspiring" many hospitals. For instance, on the orthopedic service it is being sprayed directly onto the patient's cast to offset malodors. Amphyl Spray lends itself well to this use since it leaves no sticky or greasy residue and no evidence of its having been used except the reduction in odor. As a disinfectant, Amphyl Spray is handy for frequent drenching of the base and understructure of the operating table. Be sure to send for our new bulletin on specific Amphyl Spray procedures.

In a study of one thousand consecutively operated cases from the General Surgical Wards of the University Hospital in Oklahoma City, the infection rate in 537 clean wounds ranged from 3.1% without preoperative antibiotics to 4.0% with preoperative antibiotics. In the 463 contaminated wounds, infections complicated the surgical wound in 11.9% when antibiotics were used postoperatively and in 5.0% when not used. In the clean wounds, infection was nine times greater among patients who received antibiotics postoperatively. In discussing this study, the authors say that it is becoming obvious that their use (prophylactic antibiotics) offers no real protection against the appearance of a wound infection. (American Surgeon 12:781, December, 1960)

Routine de-contamination of floors, objects, surfaces, blankets, and linens can be one of the most economic, effective, and simple control measures against infection and superinfection. Here's why—it reduces the number of organisms available for spread by any route—contact, nasal, or airborne—thus reducing both the excess hospital days and the risk of debilitating infection in both the patient and the hospital personnel.

Please write us for any of the information offered in this letter. If you want copies for teaching purposes or group discussion, please let us know how many you will need. When you have additional questions, our research laboratories and technical advisors are ready to help. I, personally, would like to hear from you at any time.

Robert E. Dickens
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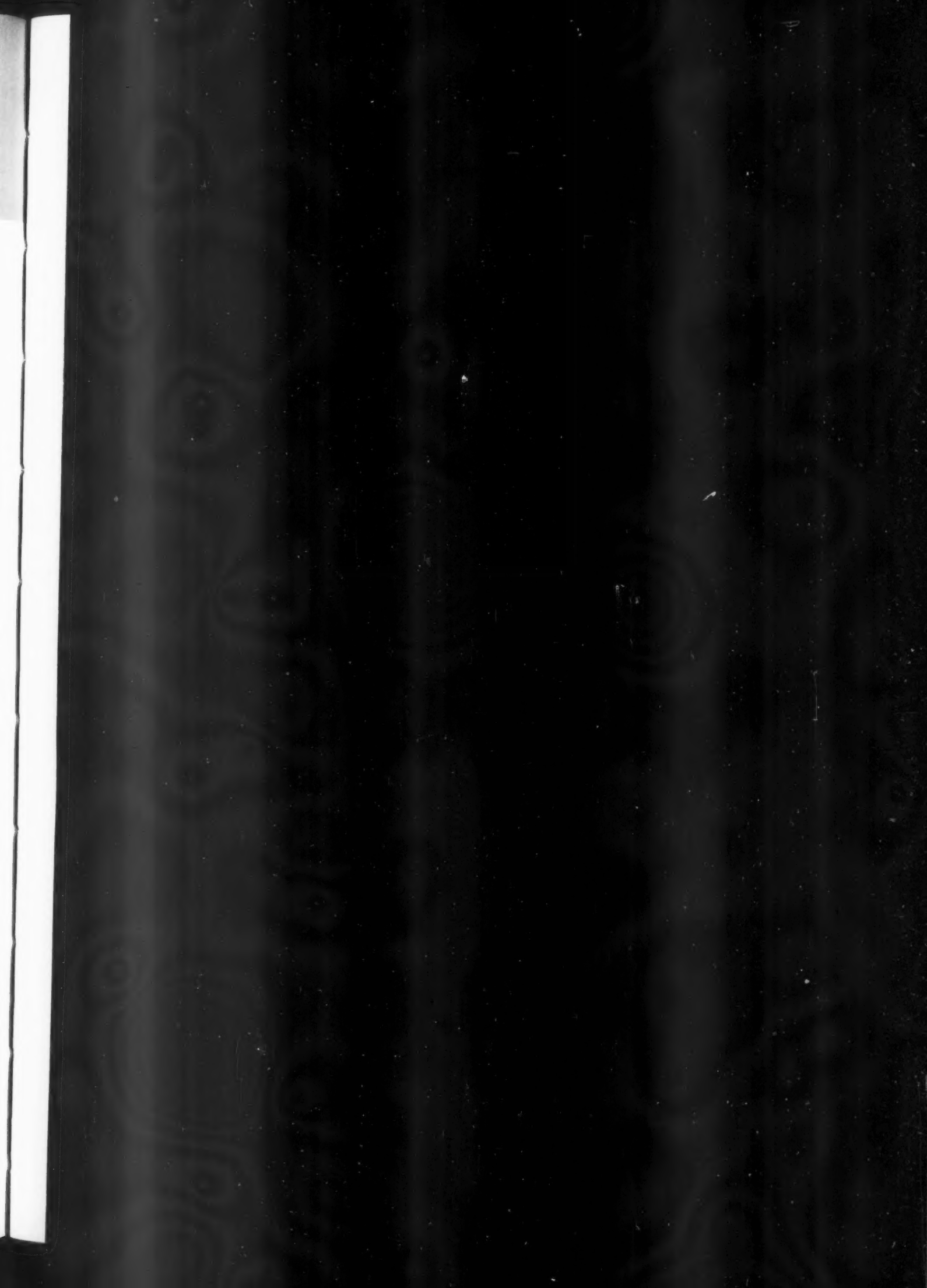

Dear Sirs:

"Selling Drugs by 'Educating' Physicians"

DEAR SIRS: One of the members of the Pharmacy Committee gave me a reprint "Selling Drugs by 'Educating' Physicians" by Charles D. May, M.D., published in the *American Journal of Medical Education*, Vol. 36, No. 1. It tells a powerful story and indicates the tremendous amounts of money and efforts aimed primarily in getting the physician to prescribe a certain trade name, regardless of whether the product has merit or what it costs the patient.

I thought you might be interested in this article. Frankly I feel that every pharmacist should digest the information in the article.

EDWARD A. HARTSHORN, *Chief Pharmacist*
Evanston Hospital Association
2650 Ridge Avenue
Evanston, Illinois

Administrators and Pharmacists Appreciate Placement Service

DEAR SIRS: We are happy to inform you that the Staff Pharmacist position at our hospital has been filled. Miss Barbara Gibson of Dallas, Texas (Re: PW-308) has been hired.

. . . we can say that we are happy to have her with us.

Accept our sincere appreciation for the extensive work of the Personnel Placement Service undertaken in our behalf.

SISTER MARY HORTENSE
Mother Frances Hospital
Tyler, Texas

DEAR SIRS: I wish to thank you and your staff for the wonderful consideration you have given me in assisting in my relocation. I have accepted a position at Mother Frances Hospital, Tyler, Texas. Again, I thank you.

BARBARA GIBSON, *Pharmacist*
Mother Frances Hospital
Tyler, Texas

Amount of Commodity Budget Spent on Pharmaceuticals?

DEAR SIRS: Would you please explain the term "commodity" as used in a recent editorial (18:109 Feb. 1961) appearing in the AMERICAN JOURNAL OF HOSPITAL PHARMACY: "Today, 30% of the hospital commodity budget is spent on pharmaceuticals."

Our hospital (199 beds) spends 2.5% on pharmaceuticals. Is this figure possible?

ALICE BANACHOWSKI, *Chief Pharmacist*
Riverside Hospital
Toledo 11, Ohio

EDITOR'S NOTE: Unfortunately, I made a mistake in my editorial and the figures should be 15.5% rather than the 30% figure which was used. According to the Guide Issue of *Hospitals* for August, 1957, page 344, the total expense in 1956 for hospitals was about six billion dollars of which about four billion dollars was for payroll. This leaves about two billion dollars for nonpayroll expenses and I assume that most of this is for commodity. During the same year hospitals spent over $320,000,000 for drugs and this is about 15.5% of the nonpayroll expense. The figure you quote for your hospital seems very low. In another case where a similarly low figure was quoted I found that the hospital's accounting system did not include as an expense those drugs which were charged to the patient. The only net figures reported were those spent by nursing units and clinics for the medication they gave away to patients during the year and for which the patients were not charged. In our questionnaire we asked the hospital pharmacists to estimate the amount that the hospital spent for drugs, and this was in terms of purchases, regardless of how the drugs were accounted for.

Request Information on Traveling Requisitions

DEAR SIRS: We are using a drug requisition which is unsatisfactory and would like to devise a drug medication card or sheet for individual patients . . . I would appreciate a sample copy from anyone using this type of form.

Thank you very much.

JAMES A. COFFIN, *Director of Pharmacy*
University of Kansas Medical Center
Rainbow Boulevard at 27th Street
Kansas City 12, Kansas

EDITOR'S NOTE: Individuals having the type of requisition mentioned by Mr. Coffin may send copies to him along with information about application.

arresting measure for surgical bleeding

When the customary surgical techniques for capillary hemostasis fail, prompt cessation of oozing may usually be obtained with OXYCEL (oxidized cellulose, Parke-Davis). This absorbable hemostatic conforms readily to all wound areas...assures a clear operating field...helps to shorten operative procedures.

Available in forms for every need: OXYCEL (oxidized cellulose, Parke-Davis). Pledgets (Cotton-type), 2¼ in. x 1 in. x 1 in.; Pads (Gauze-type) (8-ply), 3 in. x 3 in. and 4 in. x 12 in.; Strips (Gauze-type) (4-ply), 5 in. x ½ in., 18 in. x 2 in., 36 in. x ½ in., and 3 yd. x 2 in.; Foley cones (Gauze-type) (4-ply), 5 in. and 7 in. diameters. Sterile as supplied.

Indications: As an adjunct to effect hemostasis in bleeding associated with capillary oozing. ***Use:*** Strips—temporary packing of bleeding cavities, nasal passages, and tooth sockets; pads—temporary packing of surgical beds as after biopsies and to cover more or less extensive areas as in laparotomies; pledgets—in neurosurgery and in dental work for small localized bleeding areas; Foley cones—in prostatectomy.

Precaution: Excess amounts should be removed prior to surgical closure to avoid foreign-body reaction. Not to be used in sites of infection or following silver nitrate or other escharotic chemical agents. Contraindicated in clean bone surgery when poor vascularization is present and in instances where rapid callus formation is desired. Should be used sparingly in open reduction of fractures and in cancellous bone. Will not withstand heat sterilization. Remove from container aseptically.

FED. [961 (P.568)

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editorial

by DON E. FRANCKE

Ethical Standards and Professional Conduct

► ETHICAL STANDARDS AND PROFESSIONAL CONDUCT remain one of pharmacy's prime problems. This is as true today as it was in 1949. When, after several years spent in surveying American pharmacy, Elliott concluded that ethics was one of the five key problems for the survival of pharmacy as a true profession. In his final report he stated:

> After all has been said and done, it may be concluded that the outstanding factor determining the future of the profession of pharmacy is fundamentally moral in nature. The profession must contain a far greater proportion of members who are ever sharply jealous of the high reputation of the profession and who, by energetic cooperation, are determined ever to protect that reputation.[1]

Hospital pharmacy is fortunate in having a high proportion of members who are determined not only to protect, but also to enhance, the reputation of pharmacy. It is, in fact, this striving for improvement in professional practice, in education and training, in the expansion of professional services, and in other areas which has characterized the activities of the ASHP since its beginnings. Thus the SOCIETY has set into motion a dynamic, positive approach to the problem of ethics. One of the strongest forces for ethical advance is the catalytic action resulting when highly motivated professional people stimulate, encourage and inspire one another to press forward into the higher levels of professional practice. This positive approach to the problem of ethics will carry hospital pharmacy far.

One often overlooks the obvious fact that one may harm the profession, *i.e.* be unethical, by failure to perform certain acts as well as by the performance of illegal or unethical acts. The example cited by Professor Schou of the hospital pharmacist who spent his time appreciating the view of the sun playing on the river emphasizes this (see page 322). The pharmacist, to be worthy of his profession, must do more than to refuse to do the unethical or illegal act. He must also, in a positive way, bring into daily practice the scientific and professional knowledge and skills which underlie his profession. These positive acts form the basis for true, sustained professional growth.

Patterns of ethical standards and professional conduct are developed by a group during generations of service. They imply adherence to ideals, to customs, to traditions of service — the doing of certain acts beneficial to the group and to society, and the avoidance of doing acts detrimental. One of the great difficulties in American pharmacy is the lack of accepted ethical standards of professional conduct. As a result, great segments of the profession engage in practices detrimental to the profession as a whole and, consequently, unprofessional practices become the norm rather than the exception. A profession cannot long continue to act with selfish abandon and still retain either its professional prerogatives or recognition by society. Thus, as Elliott concluded, " . . . the outstanding factor determining the future of the profession of pharmacy is fundamentally moral in nature." The task of hospital pharmacists is to learn these lessons, to recognize the errors of the past, to strive toward truth by becoming aglow with the spirit of true pharmacy and, thus, to recreate a pattern of practice truly professional.

In his 1956 Whitney Award Lecture, ASHP Past-President Archambault, discussed many of the ethical problems facing hospital pharmacy and recommended the adoption of a code of ethics.[2] At the last convention, Past-President Trygstad presented the first Report of the Committee of Professional Ethics. This report was necessarily preliminary in nature since the preparation of a code of ethics is an arduous, difficult, time-consuming task. It is difficult to crystallize the ideals and sentiments of a professional group into the form of a written document. But, when done, it becomes a strong force for progress because a code is not a law but a creed. And a creed is a spirit of conduct which goes far beyond laws or regulations. It is the result of a professional consciousness that develops as the attitudes, the ideals, and the practices of hospital pharmacy develop. In turn, the creed of the individual hospital pharmacist becomes the crystallized attitude of the group.

Let us hope that hospital pharmacists do not lose their positive approach toward problems of ethical standards and professional conduct. Long ago lived a Teacher who taught us that "thou shalt . . ." is even greater than "thou shalt not . . .".

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1. Elliott, E. C.: The General Report of the Pharmaceutical Survey, American Council on Education, Washington, D.C., 1950, page 4.

2. Archambault, G. F.: Ethical Standards, Professional Conduct and Responsibilities of the Hospital Pharmacist, *Bull. Am. Soc. Hosp. Pharm. 13*:445 (Sept.-Oct.) 1956.

OUR PROFESSIONAL

ETHICS

by SVEND AAGE SCHOU

LADIES AND GENTLEMEN—
DEAR COLLEAGUES

► It certainly is a very great pleasure and honor for me to address you today.

I thank the Executive Committee and your president, as well as my friend Dr. Don Francke, most warmly for the invitation to be present here at your Annual Meeting in Chicago together with so many distinguished American colleagues.

From the time of my first visit to the States — it is now more than 10 years ago — I have had a very high opinion of the standing of the American hospital pharmacists and of their importance for American pharmacy taken as a whole. So also from this point of view is it an honor indeed to be allowed to address you.

I know — and appreciate — the American way of smoothing a professional or technical talk and to create a certain goodwill in the audience with a joke. I am sure my subject is such that it would serve my purpose to use this trick. But I am afraid my ability in this respect is rather poor, and I have in mind that an outstanding countryman of mine, the physicist and as such Nobel Prize Winner, Professor Bohr, last summer told me how careful one should be in using this method. The first time he was invited to address the Royal Society in London he had the impression that an outstanding audience needed a stimulant, a little "pick me up," so he said to himself: I had better try the American way and so he started telling a story about an Englishman who visited a scientific society in Paris where he gave a lecture. Now the whole point of the story was the way in which the Englishman pronounced the French words, and Professor Bohr's efforts to elucidate this point forced him to speak English with a French — or what he thought was a French — accent, and he himself found this very amusing. But then he looked out on his audience, nobody laughed, nobody even smiled; all of the listeners showed an intense somewhat bewildered expression and they tried hard to understand not only what the famous professor was speaking about but even which language he was speaking. So, as the really modest man he is, he said "as soon as I realized this I turned to technical matters."

Sans comparison I am convinced I shall do the same. Now ladies and gentlemen — professional ethics — what is the concept behind this expression? "Ethics

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SVEND AAGE SCHOU is Director of Pharmacy Service, University Hospital, University of Copenhagen, and Dean of the Royal Danish School of Pharmacy, Copenhagen, Denmark.

Presented at the Annual Meeting of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS, Chicago, April 26, 1961.

is the science of morals, treatise on this, *moral principles, rules of conduct,* whole field of moral science," says *The Concise Oxford Dictionary;* and for a definition of *professional,* in *Webster,* I found, "of or pertaining to a profession; as *professional ethics.*" By the way, *Webster* is one of the very rare places where professional ethics is mentioned. So professional ethics must be professional moral principles or better *professional rules of conduct.*

Yes, but professional ethics is not only professional moral, it is more than that, it is as I will understand it, the sum total of the professional man's relations with his profession as well as with his surroundings, that is to say the surroundings he faces in his capacity of a representative of a special profession, in the case of a hospital pharmacist, the doctors, the nurses, the hospital administration, etc.

Does this mean that professional ethics can be restricted to the sum of the attitudes of the professional men — or does the profession in question have a specific type of ethics, and if so, codified by whom?

The question is now, and it is a question still under lively discussion among philosophers whose main interest is ethics, do things (objects) and conceptions (ideas) have their own ethics? Is it possible to consider them ethical by themselves? A contemporary professor of ethics in my country has this view.

But, I am afraid such speculations will lead us into too subtle philosophical reflections, so I believe, I had better advocate the more materialistic point of view mentioned above, that is, that professional ethics is the sum, the conglomerate, of the professional men's ethical attitude towards their profession — the general rules of conduct implicit.

The professional ethics component cannot be separated from an individual, an egoistical factor even. The expert, the good craftsman e.g. has from the earliest times had his professional ethics, and to live up to this gave him the pleasure of his work, his professional "happiness" in his achievement of making good articles, good shoes, good— even beautiful—pieces of applied art, etc. But to separate this "happiness" from an egoistical factor is impossible as it would be forced, yes, even not human. The hand-shoemaker will at any time and with personal delight postulate that his shoes were better than those made by his competitor. And so, "our system of pharmacy is of a higher standard, if not the best at least one of the best."

This leads us to the postulate that the professional ethics is a form of utilitarianism as developed by Bentham, James Mill and John Stuart Mill in the last century. Ethics is what is good and brings happiness. But if this shall be true in connection with professional ethics, it is and must be inseparably connected with professional happiness and must include egoistic points of view.

But then the question arises as to what is good and what brings happiness to our profession? We will return to this in a moment. Our professional ethics must combine general ethical principles with specific ones relating to the society in which we are practising our profession.

The general ethical principles, the general rules of conduct, must be the general foundation on which a professional pharmaceutical ethic is built. That is to say, like all other ethical problems, our ethics are based on the moral principles codified in our religion, in our faith, in our philosophy, in our whole outlook on life. We cannot very well discuss these fundamental ethical principles today, but we take it for granted that their standing is high. Our specific ethical principles are first the classic pharmaceutical virtues such as sense of duty, reliability, carefulness, watchfulness and safety, always safety as the first and last consideration. I will take this basis for granted also, but we will not forget, that the general view has been founded on these virtues from time immemorial, and that the pharmacist is a trustworthy person, who with his professional careful and paintaking efforts forms not only the necessary link in the pharmaco-therapeutical system between the doctor and his patients, but even a bulwark of protection against mistakes between the doctor and his patient. Yes, I have personal friends in the medical profession — and influential ones — who really consider these pharmaceutical virtues synonymous with the true pharmaceutical ethic.

So far I have purposely taken pains to avoid reminding you of the not so few unattractive apothecaries, persons with remarkably, often ridiculously low ethical standards, which we find in the world literature from Shakespeare and Molière on. I do think any profession could show something similar — solicitors and doctors to mention only a few — and so we really cannot let that disturb us. Particularly inasmuch as they are not hospital pharmacists.

But now, professional ethics is not merely living up to the "virtues" and valuable qualities which the people around us, our relations, our "surroundings," attribute to us, as these are often rather unprofessional, at least in the judgment of the professional man. No, we must build up our own system of virtues in keeping with the times, giving professional satisfaction, professional "happiness." Our professional activities must be under continuous development. At any time we have to consider our responsibility towards our professional ethics.

And now, which are the means at our disposal to achieve this? You may find that some of the points I am going to mention have little or no relation to what you would call ethics, but keep in mind that professional ethics is a tessellation, each point mentioned being an important, an indispensable tessera, an indispensable detail in the general mosaic.

Achievement of Professional Satisfaction

First, *Security.* In an address to the F.I.P. assembly some months ago in Copenhagen, I expressed it in the following way: The pharmacist must know what he is dealing with. Identity and purity of all raw materials. Identity of all preparations passing his hands on their way to the patient must be ensured. The correctness and accuracy of any prescription he has to make up, of any activity he has to perform to enable the correct treatment of the patients must be secured through an always up-to-date and effective control system. This will at least in part be the subject of my next talk, so we will leave it for the time being.

Second, *Production.* I should like to quote what I said about this to an audience supposed to represent especially retail pharmacists at the occasion mentioned a moment ago.

"I am afraid a number of my colleagues will find (this point) rather hard to accept. Personally, I am convinced that *there must be a production* combined with or attached to any pharmacy; otherwise, the question arises whether the pharmacist is merely a dealer or whether he is really a professional man."

It is not enough that the pharmacist has the theoretical ability to produce pharmaceuticals; there must be a production actually taking place on the premises in order to convince himself and his customers of the fact that he is a man who knows his profession.

I know very well that this is a rather demanding proposition to make, and that it will sound unrealistic and naive to a good many pharmacists, but all the same, I am convinced of its importance. The act of instituting a production, if only to a limited extent, could in several retail pharmacies be the first though hard step on the stony way to a more decent professional atmosphere. Even in the glorious homeland of the world famous drug store, a considerable number of the pharmacists have found out that at least a certain amount of production can be profitable. Profitable not only from a financial point of view, but the pharmacist also gets professional satisfaction and a higher professional standard.

In a good many countries this will be considered utopian and unfeasible. But in my view the existence of some producing pharmacies — even if the number is small — at least will add immensely, not only to their own dignity, but also to the standard and to the esteem of pharmacy as a whole.

Why not, in countries where this is the only way to show the public what a worthy profession pharmacy really is, establish some pharmacies of a particularly high standard. The pharmaceutical organizations could set up and, if necessary, support *model-pharmacies* with a current production, with the instruments and machines characteristic of the profession at work, with a good consistent control system, and with the analytical laboratory functioning. I am convinced of the importance of such a measure. Propaganda of this type should by no means compete with private pharmacies. On the contrary, they should be, and could be, the "pet-establishments" of the profession, in which all colleagues would, or could, or should, or at least ought to take pride.

And who knows, one fine day one and then another pharmacist might find it worthwhile to imitate one thing or another of the activities and measures of the model pharmacy. The dignity of pharmacy would thus increase.

The third point again is a delicate one. It is *the question of the knowledge of the pharmacists.*

The pharmacist must know, and he must follow as close as possible and indefatigably, every development in his profession, every new product that shows up is his business. His professional knowledge is and will for the next decades be his most important quality, in a way his *raison d'être.*

The *raison d'être* of a professional man with an academic education may well be that of making a profitable living, but it is inconsistent with the professional ethics if the sole purpose is the making of a profit.

Being aware of the state of pharmaceutical skill, competence and scientific standard in quite a number of pharmacies the world over, the question arises how to establish and to maintain a high, and admirable standard in the scientific status of the man in the retail pharmacy, and in addition how to ascertain that the knowledge of the professional pharmacist be up-to-date.

It would bring us much too far if we should discuss this point in any detail. But as the energy and the interest of our busy colleagues in struggle with the practical problems of every day are also often insufficient, we who are responsible for the professional education have a severe and important responsibility in the line of "refresher-courses" and special training courses. Once we have accepted this fact, the question remains of how to persuade and how to make it possible for our practicing colleagues to follow such courses.

The practical pharmacist should feel it as his duty not only to follow every development in his profession but to bring his more fundamental knowledge up-to-date at least every five years. This could by the way be a requirement, for the renewal of the pharmacists license — why not every five years as a driving license?

Although this may sound utopian to many ears, I think such a measure would add immensely to the ethics of pharmacy. On the other hand, I must admit it represents the narrow and arduous way to professional happiness. But I can recommend to you a simple and easy way which solves at least one aspect, but an important one, of this problem.

The most urgent requirement to the pharmacist is, and will in the future be, that he knows the new

remedies. He *must* master the terminology of the remedies, of the medicaments. Why certainly you will probably say, and I agree with you, but think it over for a moment. How many of us can claim to be the just in this field?

Whenever and wherever the pharmacist becomes aware of a new remedy, of a new drug, of a new name, of a new speciality, he must file his new knowledge. His knowledge cannot very well be ahead of his time but the dignity of his profession requires him to be up to the minute at any given time. He must never forfeit his reputation of being the man who knows what is new in drugs.

Now you will probably ask: Do I really believe this can be a task for the individual pharmacists? My answer is yes.

I think the pharmacist in his shop will gain so much self respect, and take so much interest in his work through this activity, that it will prove to have a very important function in building up the professional worthiness he has lost or is on his way to lose.

On the other hand, our colleague in his shop will need all the assistance he can possibly get in this field also. But even the best handbooks — and we now have really good handbooks— do not suffice. They have more or less local or regional character and they cannot possibly at any time be up-to-date. Too, the doctors and the customers always have an indomitable desire to ask for the newest drugs, having obtained their knowledge from the original literature or what is worse from the daily papers or from popular periodicals.

What we need is a *universal* system of information, reliable and always *au courant*. As already mentioned, we do have excellent handbooks, but they are and must be behind. Furthermore, I am well aware of the different card-indexes with a rather wide distribution (The American: *pharmIndex,* The British: *Index of New Products,* the Swiss: *Remedia Nova,* the Dutch: *Documentatie,* the Danish: *Medicaminia Nova,* to mention only a few).

But the fact that we need several of these indexes and the fact that they have certain local character shows that what we really need is a universal and always up-to-date information system.

For rather long time I have had this under consideration, and as I see it now a simple system of information could be established without much trouble and, what is even more important and surprising, without too high a cost if it were built up by or in connection with an existing world-wide organization such as F.I.P.

And may I call attention to the fact, that the existing indexes form an excellent basis for a further development into the universal index.

"It is difficult to prophesy, and particular by concerning all that concerns the future," as a Danish cartoonist and philosopher of high standard once put it. But I do think the following would be able to work satisfactorily:

Every manufacturer of new drugs, every registered manufacturer of pharmaceutical specialities takes over the responsibility, (as a quite natural and cheap part of his advertising). We all know how costly effective advertising is to send an adequate number of file cards representing every new product to the office of the F.I.P. The cards should be worked out according to a simple system—the same for all specialities—and they should give information on the chemistry, pharmaceutical properties, pharmacology and clinical uses of each product. It is also very important that the time the information was collected is stated. This information cannot very well be "the truth and nothing but the truth." In the best of cases, it is the truth for a limited period of time; hence, it must be corrected at frequent intervals. As already mentioned, it is of decisive importance that the file cards are worked out in a simple and uniform way, and that the same system is used by all manufacturers.

The F.I.P. then distributes the cards to all members, including national organizations which can in turn distribute the cards or the information throughout their domain. The cards could be reprinted or the information could be published in the local professional press or in any other way which the members consider.

This instrument, appropriate in the hands of the skillful pharmacist, would prove to be, I am sure, of very high value. It would be of the same high value for the manufacturer as well as for the hospital pharmacist. It would contribute, I am sure, to a better understanding between the industry and its local representative: the hospital and the retail pharmacist. And last but not least this system would be of immense advantage for the ethics of our profession. It must be the duty of the skillful pharmacist any time to have close at hand a file concerning any new product. He must be able to give his doctors reliable information on the chemistry, pharmacy, pharmacology, doses and why not, without any medical responsibility, clinical information. The "customer" (the pharmacist, the doctors) are in the hands of the manufacturers and these again in the hands of their expert advertising staff. This means that the information is not always objective but is decorated with propagandalyric, a lyric, which as other types of lyric, is very often only slightly related to the more colorless reality. Experimental pharmacological results often lead to a brand of clinical wishful thinking and this again to a most colorful propaganda. I do think that even my colleagues from the industry will accept my point of view and I am sure they deeply regret that selling drugs has to be done by means of the same methods as selling cigarettes or soap. A certain control with the objectivity of the clinical information is in my opinion imperative.

Reliable information concerning new drugs will at any time be swallowed by the doctors as were it manna from heaven. And it is very important for the pharmaceutical profession to be able to provide reliable information.

If we succeed in this respect, then we have added immensely to the worthiness, to the esteem of pharmacy as a profession. This brings us back to the personal effort of the individual pharmacist. He must follow up the line and file any information, any name, any drug he comes across. This will add color to his file and give him personal satisfaction. Once the doctor finds out that the pharmacist knows more than he does, he will not only be a better salesman for the pharmacy, but this state of affairs may turn out to be the salvation of the pharmacists' reputation.

Do *we* have to attach the same importance to this point, when we look at it as hospital pharmacists? I am convinced that the answer must without hesitation be yes.

May I illustrate this with an experience I had some twelve years ago, when on the same day I visited two hospital pharmacies in a large, a really great American city, and may I use the words I used in my own report.

The hospital pharmacies vary a great deal with regard to their equipment and the manner in which they are run. They vary from dispensaries merely distributing factory-made medicines to hospital pharmacies of a type similar to our own. I will describe two examples to illustrate the extremes. First, we pay a visit to a hospital pharmacy supplying one of the clinics of a Medical Center in the big city mentioned. It has three rooms at its disposal, on the sixteenth floor and commanding a beautiful view of the river. One room apparently is the work-room proper, containing a single place equipped to accommodate a dispenser. The other two rooms serve as store-rooms for ready made preparations from pharmaceutical firms. The personnel consists of the apothecary and of a young technician who takes care of deliveries and cleaning. The pharmacist explains in a delighted sort of way that he does no pharmaceutical preparations of any kind. Everything is ordered ready-made, or rather he buys it through a centralized bureau who once a year draws up a contract with the firm offering the most favorable prices. He sums up his attitude as follows "It does not at all pay to make up preparations yourself, and of course I cannot possibly observe all the specifications made by the Pharmacopoeia these days—the factories have far better means of doing so." He further emphasizes that he could not possibly cope if he had to make preparations himself, whereas now he has all the time in the world to enjoy the view and appreciate the beauty of the sun playing on the river and on the palisades across the river.

We now turn to the pharmacy in an other big hospital. It is a most impressive modern hospital, built around 1935. The situation here is rather different. The chief pharmacist is a bright and interested, and a well-educated young man. He is expecting shortly to get his Ph.D. in pharmacology. He has five pharmacists working for him. All commercially available drugs are made into finished preparations in the well equipped pharmacy which has excellent laboratory facilities. Two girls are busy filling and sterilizing ampuls in a very roomy section devoted to the preparation of injections. The pyrogen-free water used for the injections is prepared in the laboratory proper, and the sterility and the *p*H of the preparations are checked in an adjoining room where occasional pyrogen content checks are also made. My question: "Why go to all this trouble when ready-made preparations may be obtained 'cheaper and better' from the pharmaceutical industry" gets an immediate and emphatic reply: "The factory-made preparations are *no* better than ours, and it is very much cheaper to prepare them yourself; remember we do not have the vast advertising expenses, and anyway our physicians here are interested in having unbiased deputies in the field of pharmacy."

It is further significant that the former hospital apothecary was about 65 whereas the latter was 35 and a former assistant professor at Columbia. No doubt remained as to which point of view represented the future.

With this, I hope you will agree with me, when I repeat: it is the duty of a hospital pharmacist, it is an important part of his professional ethics to carry on with a production or to establish a production in his pharmacy. The importance of this point is illustrated by the fact that the *model pharmacies* mentioned a few minutes ago have established themselves at least to a certain extent as identical with the hospital pharmacies in my country. The colleagues in the retail pharmacies always ask: how do they do this, how have they arranged this in the hospital pharmacy? By the way, the hospital pharmacists serve as fraternal advisors. In this connection I should like to mention that Denmark with only five million inhabitants has a number limited by law to, at present, 354 pharmacies, all with a production and a total of 12 hospital pharmacies, so even if you may find my material rather limited, the foundation is solid.

The next and fourth point is *pharmacology*. The importance of pharmacology as an essential tool for the pharmacist is now generally accepted. Here in the States this was realized earlier than in any other country I know of. It is possible that I should except France, but if so only to a certain extent.

A broad profound knowledge of pharmacology is more important to hospital pharmacists than to any other group of pharmacists. In fact, I do not think I go too far when I say that the knowledge of pharmacology is determining for the ethical standing of the hospital pharmacist.

The pharmacist, and the well-trained hospital pharmacist in particular, has excellent possibilities of becoming the trusted coworker of the doctor, even the hospital doctor, in the field of applied pharmacology. This is particularly true of all questions concerning the more and more widely discussed inter-relationship between pharmacology and chemistry. This leads me to the postulate that it is of decisive importance for the pharmacist to specifically cultivate all subjects where he has a natural advantage over the medical profession such as organic chemistry and physical chemistry. To relate this advantage to pharmacology brings the hospital pharmacist into a most valuable position in the daily cooperation with his doctors. Our knowledge of the relation between chemical constitution and biological action has reached a point where even a very well educated doctor is in need of con-

sulting an expert. In order to maintain our professional ethics we must see to it that this expert is the hospital pharmacist. This is a central point which the hospital pharmacist must realize and cultivate. I believe it to be of exceptional importance for our ethical status in coming days and it can be attained only through hard and persevering study. But as a shortcut in daily practice, the following suggestion may prove to be helpful.

In the hospital pharmacy the file of new products mentioned a moment ago could be supplemented with two more files, one based on pharmacological action and clinical use and another based on chemical constitution or, better still, on a classification into chemical groups such as barbiturates, carbamates, benzhydryle-, phenthiazine derivatives, etc.

The last mentioned file is a rather difficult one to establish, but it is worth the trouble. May I remind you that I recommended *one* file only a moment ago. But that was in an address to retail pharmacists. The difference between one and three files on new products is a measure of the difference in the knowledge required of the retail pharmacist and of the hospital pharmacist!

With these files on hand, my colleagues will soon gain the reputation of being professional men of high standard. If you should be able to answer important questions relating to pharmacology and chemistry without using the files you will be recognized as an expert or even a magician!

This brings us again to the point that the hospital pharmacist *must* cultivate and follow up his chemical knowledge. You may ask, is this really a problem relating to professional ethics?

Why certainly since a complete professional knowledge and a perfect mastering of the basic sciences are imperative for the modern pharmacy, as they are elements of the high importance for the special professional ethics. They form the indispensable tessera in a harmonious whole.

The fifth point is the necessity of *experimental scientific activity.*

Scientific work ought to be a natural activity in the hospital pharmacy. The hospital pharmacist should with enthusiasm enter into research on practical galenical problems, on analytical problems and into work in collaboration with the medical staff.

This is really an important part of the activities which form the ethics of our profession.

Don't let a problem pass you without your professional consideration: this should be solved, has it been solved, am I the person to solve it? If so, this activity will bring you personal professional satisfaction, professional "happiness" and it will thus be a new contribution to the ethics of your profession.

Some of you, my dear colleagues, will certainly think, well, why doesn't he tell me how I can ever find the time for scientific work. I assure you, you must have time for such a vital part of your professional activity. If not you will have to organize the management of your pharmacy in a better way. A hospital pharmacy without any research activity is on its way to be a stagnant, a sterile establishment.

I am coming to my last, the sixth, point now. It is a quite simple, really an obvious one. The hospital pharmacist *must* follow the *current literature.* Not only your own excellent AMERICAN JOURNAL OF HOSPITAL PHARMACY and the journals of the American Pharmaceutical Association, but the *Journal of the American Medical Association* and, in addition, the more local medical journals (the *New England Journal of Medicine* to mention only one) where your doctors normally publish their articles. Finally, the most important of the journals from abroad, the British *Nature* and *Lancet* being high on the list.

If you are able to reach the point where your knowledge in pharmaco-therapy is ahead of that of your doctors, then you are doing well and you may have attained the reputation of being a highly ethical hospital pharmacist! So studying recent literature is one of the most pressing of our duties.

There are certainly many other points worth mentioning; but let the five mentioned be the main points for to-day.

Conclusion

Well, I am coming to my conclusion now. As you will understand I find the idea that our profession could have an ethics all of its own rather unprobable. It is of course possible, and necessary, to codify the whole idea of our professional ethics as a conception characteristic of our profession, but any attempt to separate professional ethics from the human spirit is naive. It is really so naive that only the mind of a professional philosopher could ever discuss the possibility. No, the professional ethics is the sum of the ethical mind, spirit, effort, activity, ability and behavior of the whole professional population, *in casu* the hospital pharmacists. And it is on this we are able to build up the ethics of our profession.

As you will understand, I am now at the decisive *point*: it is you, my dear colleagues, who are responsible "one for all and all for one" for our professional ethics.

In your daily work, in any of your professional activities, you are the representative of our ethics. The codification of this ethic will at any time be, and must be, the sum total of your ethics, of your ethical professional behaviour.

The future of our profession depends on you, and I have the happy conviction that a good deal of the future of pharmacy taken as a whole will depend on the development and the ethical standing of hospital pharmacy.

PLASTICS
-- uses and problems
IN PHARMACY AND MEDICINE

by JOHN AUTIAN

Introduction

► THE REMARKABLE PROPERTIES AND VERSATILITY OF plastics have made them materials which seem to have no end of uses, either now or in the future. Dramatic strides have been seen in the last two decades and especially from 1950 to the present time in the unusual applications which can be possible by the use of plastics. Theoretically, it appears possible to create a plastic substance which will give any desired characteristic, as may be witnessed by reviewing the unlimited number of devices or products created in whole or part from a plastic material. The field of medicine and pharmacy has been a little slower adapting itself to plastics. Part of this slowness has been engendered by the cautiousness of both professions toward accepting a new trend without proper assessment of the implications. Within the last five year, however, more and more uses have been found for plastics in medicine and it now appears that we have reached a point where an avalanche of plastic devices is suddenly available to all groups in the health profession. The speed of the evolution to replace the usual time-honored materials by plastics has proceeded at a much greater rate than the actual knowledge concerning the safety of the device for its intended use. This is not to say that all plastic devices will produce a horrible health problem, or that even a great many untoward reactions may occur with the use of plastics. No matter how small the number of incidents may be, however, if they can be avoided, then both the pharmaceutical and medical professions are serving society on the highest moral and professional levels.

A casual review of incidents which have occurred with the use of plastics reveal that most of these incidents could have been prevented if proper testing or standards had been employed for the plastic substance. Since the hospital pharmacist is a scientific and professional member of the hospital staff, he is in an ideal position to critically examine the benefits of plastics as well as their shortcomings.

It seems quite logical, then, to assume that a knowledge of the subject of plastics in pharmacy and medicine, with the advantages and disadvantages, might be extremely beneficial to the hospital pharmacist. This is especially true when the pharmacist is called upon by the medical staff to advise on matters dealing with plastic devices. This paper attempts to approach this important subject in a manner which will be most helpful to the busy hospital pharmacist. A complete coverage of all phases of the subject, naturally, could not be achieved, and it also became apparent that certain conjectures and opinions would have to be woven into the text. This should not detract from the overall subject and may, in fact, encourage greater thinking on the part of the pharmacist about plastics. If this objective is achieved, then the worth of the paper will be established.

To facilitate the discussion of the subject, the paper has been divided into five sections. Each will be discussed separately, but in some instances one section may spill over into another section when this was felt desirable for strengthening a point or view. The sections are:

1. Plastics—General Information
2. Use of Plastics in Medicine
3. Untoward and Toxic Reactions from Plastics
4. Drug-Plastic Interactions
5. Present Guide to Hospitals in Selecting Plastic Devices.

PLASTICS — GENERAL INFORMATION

Terms and Definitions

Even though the term "plastics" is a universally accepted term, many are not aware of what it really means. One of the best definitions for the term is found in *Modern Plastics*: Encyclopedia Issue for 1960 which states: (1)

> A large and varied group of materials which consist of, or contain as an essential ingredient, a substance of high molecular weight which, while solid in the finished state, at some stage in its maufacture is soft enough to be formed into various shapes, usually through the application, either singly or together, of heat and pressure.

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For convenience, plastics can be divided into two broad categories based upon their ability to be reformed after they have initially been formed. The first group is called *thermosets* and indicates that the plastic material hardens to a set form. If this material is once again reheated, it will be impossible to achieve the original form on further manipulation of the material. In contrast, the second group, *thermoplastics,* can be reheated and shaped into the original form. In medicine and pharmacy, the thermoplastic materials play a much more important role than the thermosets.

Many plastic materials contain, besides the polymer, other ingredients which are included to give specific properties to the plastic. These other additives usually fall into the category of (1) plasticizer, (2) antioxidant, (3) stabilizing agent, (4) filler, (5) antistatic agent, (6) colorant, and (7) other specialized agents for a particular application.

For each additive mentioned above, there may be several hundred compounds which can serve in the same role. One, thus, can vision the myriad of formulas which might be available for the same type of plastic substance. For example, polyvinyl chloride tubing can be made from over 200 basic formulas, yet the term "polyvinyl chloride" is used to designate all of the tubings. In commerce, the plastic material is usually identified by the generic name of the polymer, *i.e.,* polyethylene, polystyrene, etc. Fortunately, not in all instances is there a necessity to include additives. Many plastic products can be produced from essentially the pure polymer. Even these products, however, may contain in minute amounts an additive which is either added for a specific purpose or is picked-up as a contaminate during the manufacture of the product.

At times, the term *resin* is used in plastic technology and invariably this means the pure polymer. Special features may be possible when two different types of polymer are joined together to produce a plastic substance. The descriptive term, *copolymer,* may then be used to designate this particular substance.

The polymer (or the basic resin) is usually prepared into a liquid or granules or a powder. When these resins are to be made into a particular item, the additives (if needed) are added and mixed into the polymer. Various processes then may be used to actually produce the specific device. In many instances, a number of firms contribute their talents from the initial synthesis of the polymer until the final plastic product reaches the consumer.

Characteristics of Plastics

Since the hospital pharmacist is coming in contact with various kinds of plastics each day, it might serve a useful purpose to present a brief review of a number of plastics under their generic title. Obviously, the review will be limited in scope and may even present an oversimplification to those who are familiar with plastic, but since it is primarily directed at those who have little background in the field of plastics, it is felt that the attempt is justified. All of the plastics to be discussed, except one (silicone rubber), are of the thermoplastic variety. The reader should keep in mind, however, that thermoset plastics also play a role as parts of instruments, devices and certain containers. They have not been included in this paper because they have not been a real problem or because their use has been well-known for a long period of time.

Polyethylene

Perhaps the most used and most popular plastic material is polyethylene, a polymer prepared from ethylene. It has an opaque appearance and is waxy to the touch. At present, there are three types of polyethylene based upon density: (1) low density or regular, (2) medium density, and (3) high density. The low density has been in commerical use for a number of years, while the medium and high density are of comparative recent vintage. Even though the density difference between the high and low is no more than 0.03 Gm./ml., the physical properties from one to the other are appreciably different.

As the density increases for the polymer, the permeation rate decreases while the distortion temperature and rigidity increases. One can see, then, that (depending upon the property desired) one of the three density types might give the most desired product. For example, if it is desired to have a device which will withstand autoclave temperatures, then the high density type will have to be used, since the low density will deform at much lower temperatures. If a product contains volatile substances, the use of the high density type will appreciably reduce the permeation in comparison to the low or medium density type. Greater flexibility will be achieved for the plastic device with the low density than the medium or high density. Unfortunately, at times, one good property also presents an undesirable property and various approaches are used to find a polyethylene or polyethylene blend which will produce optimum properties.

Polyethylenes are used for syringes, tubings, containers, other pharmaceutical and medical devices, packaging materials, and many other uses. It appears that there is no end to the use of the material. One distinct advantage it has over a number of other plastics is that it is relatively inert to chemical agents and can be made into products without the necessity of any additives, thereby circumventing any leaching problems.

Polypropylene

Like polyethylene, polypropylene is an aliphatic hydrocarbon polymer but was introduced to commercial production just in the last three years. This polymer is the lightest plastic known. Two types of the polymer exist, referred to as isotactic or atactic. The isotactic type of polypropylene is composed of spacially, well-ordered atoms in the chain, while the atactic is more in the form of a disordered arrangement of the atoms. Each type gives certain properties and a combination of both makes it possible to achieve optimal properties which makes polypropylene a plastic material with a great potential in the future. Some of the disadvantages of polyethylene may be overcome by the use of polypropylene with no real diminution of polyethylene's advantages. It appears that polypropylene may be used for all the applications that polyethylene has been used for. As cost decreases, greater use undoubtedly will be made for this particular product. In many applications, polypropylene needs no additives.

Polyvinyl Chloride

A great number of vinyl polymers are present today of which polyvinyl chloride is one of the more important ones. For most applications, however, additives must be added to the polymer to achieve the desired results. At times, as high as 40 percent of the plastic is composed of plasticizers and other additives. Careful consideration and a complete understanding of the technology of plastic production are needed to produce a polyvinyl chloride product. Polyvinyl chloride has received considerable attention by the packaging industry for film packaging of cosmetics, detergents, and drug products. Most tubings used today in pharmacy and medicine are prepared from polyvinyl chloride. The high concentration of additives may cause problems when these tubings are in contact with drug and nutritional products.

Polyvinyl Chloride-Acetate

Certain advantages may be gained by combining two polymers together into one plastic material to form a copolymer. One example is polyvinyl chloride-acetate, prepared from vinyl chloride and vinyl acetate. This plastic material has the strength and desirable properties of polyvinyl chloride but also the increased flexibility due to the vinyl acetate. Further modifications can be imparted to the copolymer by the addition of various additives. Increasing use is being made of this material in packaging of small items in a manner referred to as "skin-packaging." Individual dosage forms of drugs may be packaged in this way under mass production methods.

Polymethyl Methacrylate

This polymer is prepared from the monomer, methyl methacrylate, by a simple polymerization step with the aid of a catalyst. The polymer is quite stable to chemical attacks and resists the action of light or oxygen. Since it is also an optically clear plastic, it has found many outside uses where weather might be a deterrent in the use of other substances. Its machine-ability, strength and optical properties make it a good replacement for glass. Its relative high cost, however, has limited its use in the field of pharmacy and medicine even though for certain applications it is, by far, the most suitable plastic material.

Polystyrene

Polystyrene is one of the oldest plastics known, but its useful properties did not come into prominence until about the time of World War II. It is now one of the least expensive plastic materials and is finding many uses in the field of pharmacy and medicine because of its optical properties as well as its rigidity. Plastic syringes, ointment jars, medication cups, parts of administration kits are just examples of the uses made of polystyrene. Polystyrene will not withstand temperatures much above 80° C., and a number of chemical agents will attack the polymer. Containers made from polystyrene are not the most suitable for those agents which must be protected from vapor or other gases.

Polyvinyl Alcohol

An unusual property of polyvinyl alcohol is its property to dissolve in water while not being attacked by less polar organic compounds such as the aliphatic and aromatic hydrocarbons. Polyvinyl alcohol is now being used as film packets for packaging detergents, food products, cosmetics and drugs which when dropped into water will dissolve the plastic, releasing the contents.

Nylon

Commercially, three types of nylon are available based upon the type of reactants used to prepare the nylon. The three types are:

1. Nylon 6/6—most common (6 refers to the number of carbons in both the acid and diamine used for preparing the nylon)
2. Nylon 6—prepared from caprolactam, a six carbon condensed amide
3. Nylon 6/10—sebacic acid is substituted for the adipic acid

The basic reaction involves the use of a dibasic acid with a diamine. Perhaps the greatest advantage of these polymers is the extreme high distortion temperature, strength and toughness. Their general inertness to a variety of chemicals and solvents have made it an ideal plastic for a great number of applications. Nylon is used where hard wear and changes of temperature might cause a breakdown with other plastic substances. Aerosol bottles are made from nylon, while glass bottles can be protected from shock and breakage by coating the glass with nylon. Film packagers have investigated nylon film as excellent packaging material for oils and oily products since no ill effect appears to occur even to the nylon or its contents on long standing.

Polycarbonate

A new development in the plastic field is the introduction of polycarbonate. Even though this plastic material has not had much actual application because of its newness, there appears to be a bright future for its use in all fields, including pharmacy and medicine. Polycarbonate has a low water adsorption rate, high impact strength, excellent dimensional stability and compares favorably with nylon in regard to withstanding high temperatures. Another important characteristic of this plastic is that it has clarity and transparency which might be quite useful for containers, syringes, etc. The percent cost, however, precludes its early adoption to items where cost is an important consideration.

Cellophane

At one time this plastic (regenerated cellulose) was used more than any other plastic material, primarily as a packaging material. It has given way in recent years to other films, notably to polyethylene, because of certain inherent disadvantages in cellophane. Much more use is made of it today in combinations or as laminates with other plastic materials where low cost and ample protection to the product are necessary.

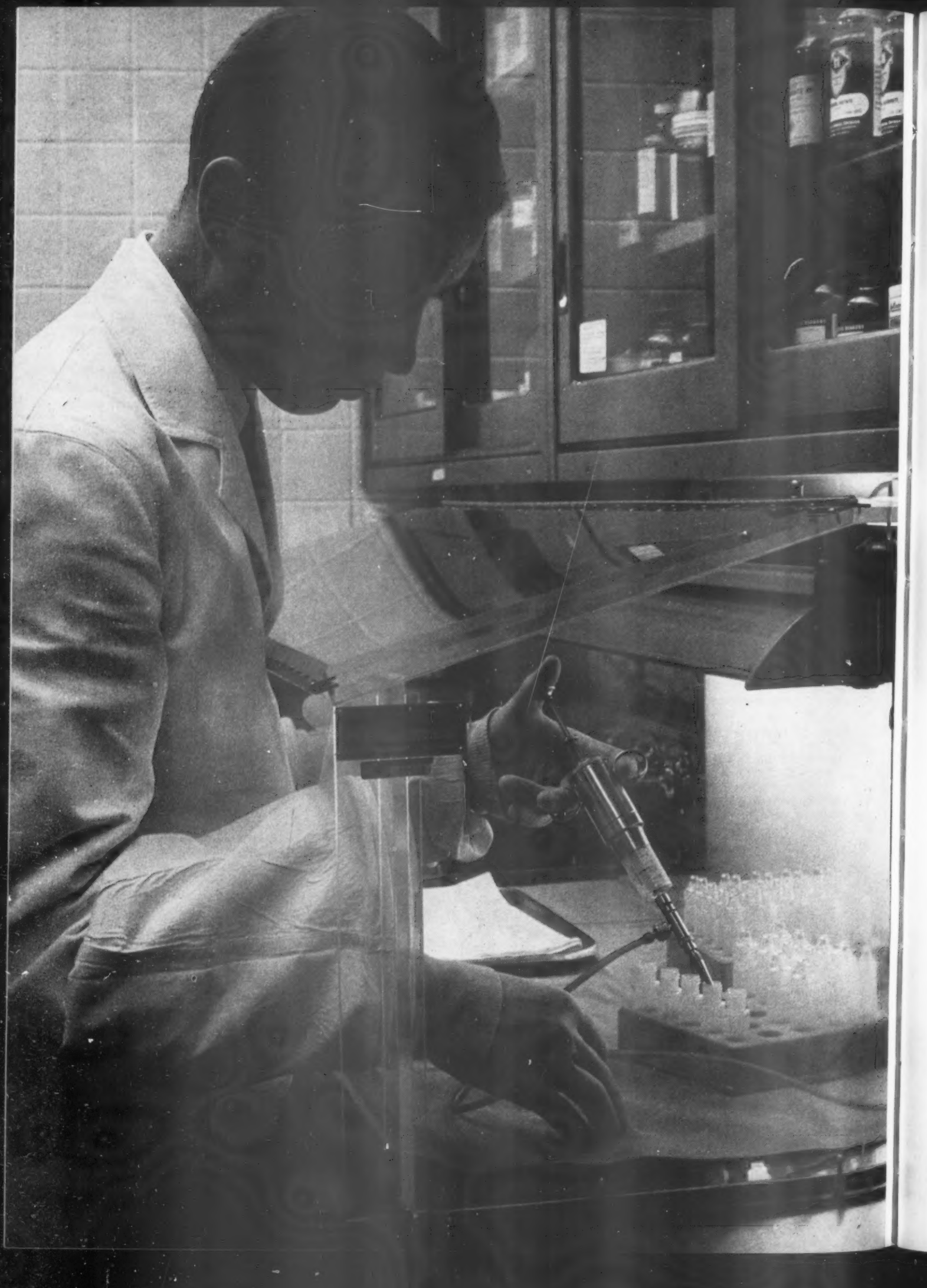
Silicone Rubber

Chemically, silicones may be considered as semi-inorganic polymers (organopolysiloxanes) which belong to the thermoset group. Depending upon the arrangements of the atoms in the polymer, a host of properties become available. Silicone rubber has the better properties of silicone and rubber with a number of the disadvantages minimized. Its inclusion in this list of plastics is because of its value in medicine where it has been used as implants and prosthetics.

Other Plastic Materials

A host of other plastic materials are also available which have merit, depending upon a specific use desired. It must suffice to mention these just by listing them.

Acetal Resins (Delrin)
Cellulose Nitrate
Cellulose Acetate
Cellulose Acetate Butyrate
Cellulose Propionate
Ethyl Cellulose
Chlorinated Polyether (Penton)
Fluorocarbons (Teflon, Kel-F)
Polyvinyl Acetals
Polyvinylidene Chloride
Polyesters (Dacron)
Phenolic Plastic



USE OF PLASTICS IN MEDICINE

Plastics in Surgery

Each day that passes finds more information in medical literature concerning the use of plastics in one way or another to achieve a definite medical objective. It is undoubtedly true that the total use of plastics in the field of medicine is comparatively slight when compared to the total quantity of plastics produced in this country, but it would be unwise to assume that the medical needs are not significant when one considers the implications that these plastic substances have in correcting or mitigating physical ailments which in a number of cases might be fatal.

It is interesting to note the rapid progress being made by surgeons in the use of plastic substances to replace in part or whole various body organs or structures. Even though homografts have proven quite satisfactory in the replacement of damaged or diseased vascular components, it does present the problem of limited availability in time of need. Other inconveniences are also associated with the use of homografts, such as procurement and preparation. For these reasons, many surgeons have explored the use of various plastic materials as a substitute for the homografts.

De Bakey and associates[2,3] have studied a number of synthetic polymers such as Ivalon, nylon, Orlon, Dacron and Teflon for replacement of different segments of the aorta and peripheral arteries and found that a seamless knitted Dacron produced the most encouraging results. These studies were started in 1957 and, up to the present time, many hundreds of grafts have been performed with about 90 percent success.

An elastic, seamless woven nylon prosthesis has been used by Szilagyi, *et al.*[4] as a replacement of long and narrow arterial segments. The elastic qualities of this nylon yarn had advantages over nylon or Teflon woven into tubes.

A serious problem in the use of synthetic polymers as prosthesis for segments of the aorta has been pointed out by Schenk, *et al.*[5-7] They found in their studies that synthetic grafts inserted into the thoracic aorta would not conduct pulsations as compared to the homografts. Parsonnet, Schloss and Eslami,[8] however, found that crimped nylon grafts would transmit normal pulsations contrary to the opinions of Schenk's group.

A number of patients have been spared the consequence of aortic insufficiency by the skill of the surgeon in replacing the valve. Kay[9] and his associates have used a woven porous plastic aortic valve which permits the tissue matrix and endothelium to grow and diffuse into the valve. Silicone rubber has also been explored by Lillehei[10] as a plastic replacement for the aortic valve. Other workers, notably Long[11] and Muller,[12] have reported the successful use of plastic substances for replacement in part or whole of the aortic valve. Spitz and Nulson[10] have employed silicone rubber tubes and valves as ventriculovenous shunts in the treatment of hydrocephalus patients. Sixty percent of their patients showed both physical and mental improvement after implantation of the shunts. It has been estimated that approximately 1200 valves are inserted each year in hydrocephalus patients.

Vineberg[13] has reported the successful utilization of polyvinyl sponge as a prosthesis for coronary arterial insufficiency. His group implanted thin sheets of the plastic sponge between the pericardium and the myocardium. The plastic material then acted as a support and growth stimulator for blood vessels outside and into the heart muscle. Eleven "poor risk" patients have been saved and are alive today because of this technique.

In a critical evaluation of Ivalon in animal studies, Jones, *et al.*[14] suggested the use of this plastic material for:

1. Abdominal aortic grafts.
2. Compilation aortic grafts in growing patients.
3. By-pass grafts between arteries that are more than 7 mm. in diameter.
4. By-pass grafts as temporary shunts to facilitate aortic surgery.
5. As a hemostatic agent in the repair of liver and kidney wounds.
6. Repair of tissue defects, especially in the diaphram.

High density polyethylene in the form of a very fine mesh has been used by Usher, Ochsner and Tuttle[15] in the repair of incisional hernias. In another study, Usher and Gannon[16] noted that the high density polyethylene also has advantages over the conventional polyethylene because of its (high density) high softening temperature and high tensile strength, two physical properties very desirable for vascular prosthesis. Other uses in the repair of tissue damage of the chest and abdominal wall have been reported by Usher, Fries, Ochsner and Tuttle.[17] This surgical mesh is now marketed in a sterile package* which may be opened when needed, insuring sterility.

A great many uses are being found for various plastic materials in the field of plastic surgery. Of recent interest is the report of Dr. Eugenia V. Gruzdkova,[18] of the Moscow's Central Institute of Traumatology and Orthopedics. She reported that Russian surgeons are achieving 90 percent success in the use of polyethylene-like substances to repair congenital surgical and traumatic facial defects. The most successful plastic material used by the Soviets was polyvinyl chloride. Over two hundred cases were cited in which facial damage was successfully corrected.

*Marketed under the trade marked name of "Usher's Marlex Mesh" by Davol Rubber Co., Providence, Ohio.

Implantation techniques have been utilized by a number of surgeons for the purpose of increasing the size of underdeveloped, human female breasts. The objectives of such surgery appear to lie in the psychic value to the patient. Many women, apparently, have overcome mental disturbances caused by hypoplastic breasts after plastic implants have been added. Pangman and Wallace[19] have reported the gratifying results in regards to morale in nearly 400 female patients after breast plasty.

An experimental plastic reservoir has been developed by Bogash and associates[20] to replace the urinary bladder. Great hopes are given to this synthetic bladder for the future. Kistner[20] has been able to utilize a plastic tracheostomy tube which permits the patient to cough and even to speak in a normal manner. Successful tendon repair in rabbits by the use of plastic materials has been reported by Artamonova.[21] This successful procedure in animals gives promise for human tendon repairs. Recently, a urethane polymer has been used to cement fractures of the bone, thus eliminating the usual external supports as now used.[22] The real success of this procedure, even though promising, cannot be foretold until several years have passed. One certainly cannot deny that this "bone glue," if successful, will revolutionize the treatment of fractures, providing a new and valuable tool for the physician as well as comfort and mobility for the patient.

Devices Used in Medical Practice

A host of uses are being made in the field of medicine for plastic devices. Undoubtedly, this trend will continue and even increase with further expansion of the plastic field. At present, the variety of plastic products utilized by workers in all fields of medical practice are formidable, and to delineate all of these used would be beyond the scope of this presentation. It may suffice, however, to include representative products which contain in whole or part a plastic material.

Tubings

Plastic tubings extruded from polyethylene or polyvinyl chloride have appeared in ever increasing numbers to replace the usual rubber tubing for a variety of applications. Many advantages may be enumerated when comparing plastic tubings to rubber tubings.

It is possible to formulate tubings which will result in any degree of clarity or color. A clear tubing can aid the nurse or physician in visualizing the flow of a liquid (drug, blood, body exudate) in or out of the body. Color coding of tubings help to identify the specific use of the tubing. For example, a specific colored tubing could easily identify the gauge of the tube, or a color coding system might advantageously be employed in a hospital to indicate that a certain prescribed injection can be administered only through a specified colored tubing. In effect this type of procedure could help to reduce sources of errors in the administration of drugs.

Variation of the formula for a plastic tubing can result in producing a device sensitive to normal methods of sterilization (autoclaving or boiling). At times, this type of tubing is desired for blood donor sets or certain types of catheters which are to be packaged as sterile one-use disposable sets. There is no opportunity for these sets to be used again since sterilization by heat will melt or distort the tubing to such an extent that their re-use is prohibited. Obviously, the advantage of a plastic tubing just described is the one-use application, at which time the set must be discarded. Since it is believed that cross infection and the spread of infectious hepatitis is due, in part, to the re-use of tubings and other devices (thought to be sterile), the use of disposable sets should help decrease the incidence of cross infection. In other cases, plastic tubings are available which can be washed and sterilized by normal methods.

Syringes

The current concern by clinicians in the spread of infections in hospital wards has given impetus to the hospital administrator to procure where possible one-use disposable devices for the administration of therapeutic agents. As has been mentioned, there is substantial evidence that the spread of certain infections, especially hepatitis, can be attributed, in part, to the re-use of devices including syringes and needles by the hospital personnel.

In order to create disposable syringes which could successfully compete with the conventional glass syringes, the surgical supply manufacturer has turned to using plastic materials in the construction of the barrels and plungers. Each syringe unit is then encased in a suitable plastic package and sterilized by either gas or electronic methods. Depending upon the manufacturer, the needle may be affixed to the barrel or may be included separately in another disposable package.

To the most important advantage—sterility—other advantages may also be added. These are:

1. Patient discomfort will be reduced since each injection will be with a fresh, sharp needle.
2. Psychic comfort will improve when the patient understands that the needle will be used only once.
3. Cost per injection may decrease since cost of reprocessing, cleaning, sharpening needle point and sterilizing will be eliminated.
4. Breakage of syringe and loss of medication will be eliminated.
5. Nursing personnel will find greater convenience in use.

In most instances, the plastic syringes appearing on the market today are composed of polyethylene, polypropylene, polystyrene and nylon. The polyethylene, polypropylene and nylon syringes are more flexible but lack optical clarity in contrast to the glass-like appearance of polystyrene.

Disposable hypodermic needles are now also available in sterile, sealed envelopes. When needed, the clinician or nurse can break the seal and affix the needle to the syringe (either glass or plastic) without touching the needle. To make the needles a one-use feature, the manufacturer has replaced the metal hub with a plastic hub.* The low cost of manufacture of this type of disposable hypodermic needle places it in favorable competition with the more expensive, many-use conventional needle. An added advantage of the plastic hubbed needle, however, is that it cannot be used except once, since sterilization by heat will melt the hub. This insurance of one-use only is certainly an added comfort to the responsible clinician who is ever aware of the hazards of transmitting infections in a hospital by the re-use of supposedly sterile needles.

Other innovations have been added to syringe design through the versatile properties of plastics. One disposable polyethylene syringe with attached needle is designed in such a manner that the plunger is made with a hood which telescopes the barrel and prevents the plunger from ever

*"Discardit - Sterile Disposable Needle," Becton, Dickinson & Company, Rutherford, New Jersy.

being detached from the barrel, yet permits complete flexibility of movement of the plunger.* Another design of a syringe entails compartmentalizing the barrel into two chambers, one containing the vehicle and the second the medication.** When the injection is to be made, the plunger is pulled out releasing the vehicle into the medication chamber. Activation of the plunger again (inward) injects the constituted medication.

Blood Collection and Administration Sets

Even though blood collection in one location and administration of the same blood to a patient in another location dates back to before World War I, the practicality of massive collection, storage and administration of whole blood through blood banks did not become a reality until the Second World War. The best of techniques, however, in the collection of human blood still does not prevent some damage to the blood cells. Collection of blood into a glass bottle by gravity or vacuum can cause frothing which injures some of the blood components. Part of this frothing is due to the wetting nature of glass. The use of non-polar plastic materials such as polyethylene to replace the glass bottle and the rubber or glass collection tubing has extended the viability of whole blood over the usual collection method. Since the non-polar polymer is hemorepellent, less shock or vibration is exerted on the cells. Further advantage is achieved in the use of the plastic since there is no silica or other particulate in the plastic to leach into the blood.

Today all-plastic collection units, previously sterilized and containing an anticoagulant, are available. The blood is collected into a plastic bag through a plastic tubing. The unit is sealed, stored under prescribed conditions and transfused to the proper patient from the same unit, insuring sterile, pyrogen-free blood. After the transfusion, the plastic unit is discarded.

Other plastic units are manufactured which can be used to collect the blood and to separate the components without the necessity of ever opening the closed system.*** The advantages of such units need not be described to those concerned with blood therapy.

Drug-Nutrition Administration Sets

Manufacturers of parenteral products have also recognized the advantage of using plastic materials in various forms in administration sets for their own products. Basically, these sets contain a clear plastic tubing with a suitable connecting fixture on one end which can conveniently be inserted into the container of the parenteral product without exposing the medication or nutritional supplement to possible contamination. The other end of the tubing is affixed to a plastic adapter which, in turn, can be easily attached to a sterile needle. The unit is sterile and packaged in cellophane or in another plastic material. Disposability is another advantage of these sets. Other administration sets are available which will meet the specific needs of the particular route or technique of injection employed. Much time can be saved and less confusion will result with the use of these disposable, plastic administration sets.

With the cost of labor continually increasing in hospitals, disposable sets will become even more popular since these costs will basically be fixed, while the cost of collecting, cleaning, sterilizing, examining, packaging, etc., of the conventional administration units will rise.

*Designed and distributed through: E. H. Wilbur Corporation, Rutherford, New Jersey.

**Designed and distributed through: Silver-Fuller Industries, Franklin, Conn.

***Distributed through: Fenwal Laboratories, Framingham, Massachusetts.

Collection Units

In the past, great difficulty was experienced by the physician, nurse, etc., in collecting urine samples from infants. The most suitable method employed was to use a glass tube fastened by an adhesive strap to the youngster. This procedure was not only burdensome but had possible dangers associated with it since the glass could be easily broken. A plastic collection bag has now been devised which can be simply and safely fitted over the genitalia and securely anchored to the body by means of an adhesive material around the top and inlet of the bag.[23] Further, the bag is constructed so that it will not collapse in use, yet the side next to the patient is flat. After use, the bag is removed and sealed by folding the open-end over and pressing the adhesive surfaces together. Sterile urine samples can thus be collected without resorting to catherization.

Other Uses - In Pharmacy and Medicine

Excellent use has been made from a fluorocarbon polymer (Kel-F) as an arterial blood filter in open-heart surgery.[24] A special technique can impart transparency to the normally translucent plastic. The unit has been in use for several years at the Jewish Hospital in New York. The material, besides having clarity, is non-wettable, will not harm the blood cells and can be autoclaved.

Other ingenious uses are being found for plastic materials in the field of medicine and pharmacy. Experimental work is now being conducted on self-sterilizing syringes and containers which will release a sustained dosage of a bacteriocidal agent to a solution.* Already one or more drug products are on the market which are composed of a polymeric material. The active agents are imbedded in the resin and are released over long periods of time by a leaching process.

Hospital pharmacists are finding that a number of advantages can be gained if the pharmacy, itself, packages dosage forms in various plastic substances. Bogash has demonstrated the worth of this type of operation at Lenox Hill Hospital, New York. Skolaut and his group are actively working on the use of plastics for packaging of drugs and other hospital supplies at the Clinical Center (NIH, Bethesda, Maryland). At the same institution, Hugill has suggested the value of polyvinyl alcohol as a packaging material for dispensing pre-measured medications.[25] Sister Mary Florentine[26] has reviewed the work her group has done on the packaging of ophthalmic solutions and feels that plastic materials, such as Kel-F, would offer unusual benefits over the conventional methods of dispensing ophthalmic solutions.

Certain heat-resistant plastic materials such as nylon appear to be excellent wrappings for items such as gauze dressing when these items are to be autoclaved.** After autoclaving the wrapper can act as a packaging material protecting the gauze from contamination.

A very recent innovation which might have excellent possibilities in the field of pharmacy and medicine is the use of microporous plastic materials which can be prepared in such a way that a solution can be retained by it.*** When this plastic material is placed in contact with another substance or the skin, a film of the solution will appear on the surface. The physical property of this plastic material can be made to look and feel like a very soft rubber.

There is no doubt that plastics are here to stay and each day that passes undoubtedly brings a new use for plastics in the field of pharmacy and medicine. There are shortcomings, to be true, as we shall see, but diligent research and studies by the plastic industry, pharmaceutical industry, various academic institutions and by the hospital staff, including pharmacy, should help to overcome the disadvantages or to circumvent them in the future.

*In our own Laboratory.

**Sister Mary John, Chief Pharmacist, Mercy Hospital, Toledo, Ohio. Reported at December 1960 meeting AAAS, New York.

***Johnson's Wax, Racine, Wisconsin.

UNTOWARD AND TOXIC REACTIONS FROM PLASTICS

General Comments

Even though the progress made in the use of plastic materials in surgery has been remarkable in the last decade, and especially in the past few years, a number of problems have developed which still await to be resolved. A review of the voluminous literature on surgical procedures involving plastics quickly points out the fact that there is considerable latitude of opinion over which polymeric material or which surgical technique is the best. In many instances the results of one worker have contradicted the results of another. This sounds alarming, but the situation can be appreciated if one thinks of the many variables involved in the implantation of plastics as a replacement or support for various vascular structures. In fact, it would indeed be very difficult for one to delineate the variables when applied to human patients. Such factors as age, general physical condition of the patient, magnitude of defect to be corrected, location of implant, size of implant, and specific surgical technique utilized are some of the variables which may be mentioned. There are also the variables associated with the plastic material itself. The same generically named plastic material may vary from source to source or even from the same source. Furthermore, the form of the plastic material (for example, tubes *vs* weaves, seamless *vs* stitched, mesh *vs* non-meshed, etc.) may produce differing results. To be sure, as time passes and more data are accumulated and evaluated on more scientific grounds, a clearer understanding will undoubtedly emerge as to the proper place of synthetic polymers in medicine. However, up to the present, certain problems and untoward reactions have occurred which may warrant a closer look and consideration.

Failures of Grafts

There have been instances where synthetic arterial grafts have burst or leaked after many months of apparent success. Ohara and Nagano[27] have reported the death of a man after a synthetic prosthetic was transplanted into the aorta. The initial success was followed a year later by death caused by rupture of the prosthesis, spilling blood into the gastrointestinal tract. In another instance,[28] a ruptured abdominal aortic aneurysm was treated by replacement with a synthetic graft. The patient survived and lived for a period of 14 months before a fatal rupture of the synthetic graft occurred. Other cases have been cited in literature and undoubtedly more reports will appear in the future concerning failures after initial success. Perhaps the main reason for these failures is that plastic materials, after implantation, lose several of their initial good physical properties. Newton, Stokes and Butcher[29] have studied the alteration of arterial substitutes and found that the elastic behavior of these arterial replacements varied from one another by a considerable degree. They concluded that the "stiffening" of the substitutes was due primarily to deposits of scar tissue around the implanted prosthesis.

Szilagyi *et al.*[30] recommended that periodic aortography could be a great help to the clinician in decreasing the hazards associated with aortic grafts. Any unusual changes in the prosthesis would then alert the surgeon to initiate corrective measures. There is much to be done, however, in this area. Further assessment of the value of synthetic prosthesis will have to wait until sufficient time has elapsed to show the results of present implants. Admittedly, much is desired in a plastic material for arterial replacement, but one cannot deny the help these synthetic grafts have given to prolong the life of the doomed patient.

Skin and Tissue Sensitivity

In the early days of plastics, many incidents of tissue irritation and skin dermatitis were seen when the plastic material came in contact with the tissue or skin. These irritations in most instances were not due to the polymer but to the lower molecular weight polymers and monomers, as well as to additives in the plastic. Since many of the plasticizers and curing agents are known irritants, their presence, even in minute quantities, may precipitate unfavorable responses. Thus, the absence of monomers or other additives from the plastic substances would reduce the potential danger from tissue or skin irritation from a chemical source. In many instances, this type of "virgin" polymer can, and is, being used as a prosthetic device or as a tissue support in surgery. There are instances, however, where certain physical properties such as elasticity, pliability, clarity, low or high melting point, etc., are desired in the plastic product and in these cases, it may be quite necessary to add plasticizers, fillers, and other additives.

Much information has appeared in the literature both in the medical and dental fields on tissue sensitivity. It is unfortunate, however, that the scattered data, on closer examination, may be misleading since in a number of instances the tissue reactivity reported could have been caused by other factors besides the polymeric material. For example, individual sensitivity and mechanical abrasion in a number of instances were completely overlooked. Of course, this still should not detract from the possibility that reactions do occur which would not have occurred if the plastic material had not been used.

Brewer and Bryant[31] found some "medical grade" tubings would show very obvious tissue reactions when implanted in animals while others would not produce these reactions.

Carcinogenic Reactions

Oppenheimer, Oppenheimer and Stout[32] in 1948 reported that fibrosarcoma had developed in rats which had their kidneys wrapped in cellophane. Since that year, a number of other reports have appeared in the literature showing that plastics can react as carcinogenic agents when they are kept in long contact with animal tissue.[33-37] Surprising enough, it was demonstrated on a number of occasions that the pure polymer was the carcinogenic agent rather than one of the possible additives. The exact mechanism of the production of carcinoma, is still one of speculation, but one current thinking supports the possibility that the plastic material induces cancer indirectly by interfering with normal physiology of the cells.

Production of cancer in man by a polymeric material has not been truly demonstrated. There is strong belief that high polymeric materials might have some influence in creating a condition which might lead to cancer. A few isolated reports[38,39] have appeared where hair sprays have caused cancer-like reactions in women, but others[40] have disputed these results. There seems to be general agreement, however, that improper use of hair sprays over a long period of time could conceiveably lead to cancerous manifestations.

At this time, it is extremely difficult to prophesy what effects plastic materials might have on man in regard to cancer. One factor seems to be quite essential for the plastic material to act as a carcinogen and that is direct contact for a long period of time with tissue. In animals, one to three years have produced cancer in some cases, and if this could be extrapolated to man, it might require 30 to 50 years to produce the same result.

Other Toxic or Untoward Reactions

A problem which has received little attention in the past, but which has perhaps greater implications in regard to health hazards than many suspect, is the drug-plastic reaction to be discussed in some detail in the next section of this paper. Fortunately, at the present time, no bonafide toxic response has been attributed to a "leached" constituent which might enter a parenteral fluid and eventually into the body of the patient. Even though no medical reports are as yet available, there should be concern that a leached constituent can be injected into the patient. One should not rule out the possibility that clinicians may actually see untoward symptoms in the patient but, not being aware of the possible leaching effect, may ascribe the symptom to other causes.

From another aspect drug-plastic reactions may cause a health problem. An interaction between the plastic and the active constituent in a drug product would reduce the potency of the product and deny to the patient the prescribed dose. Even though this may not cause a toxic response, the patient's illness is not helped a great deal. Since the nurse or physician may not see visible signs that there is an interaction (binding) between the plastic and the drug, therapy may be continued without much mitigation of the illness.

One other problem may be encountered with plastic devices which are to be used as sterile items. Since usual sterilization methods cannot always be used, other methods such as gas sterilization, radiation, ultrasonics and chemical sterilization must be employed. Depending upon the plastic material and the specific method of sterilization, all microorganisms may not be destroyed. There is some fear that certain spores can be imbedded in the matrix of the plastic in one way or another and then might migrate to the surface and become viable even though a sterilization method has been used. Brewer and Bryant[31] caution those using plastic materials that new testing methods should be employed rather than the time-honored ones to insure that the plastic substance is not toxic or incompatible with tissue.

Still another problem, but one somewhat different from the usual toxic or untoward responses alluded to in the previous paragraphs, is the poor design and sometime "shoddy" manufacture of certain plastic devices. For example, a number of ophthalmologists are not too pleased with plastic dropper bottles used for ophthalmic solutions. Their displeasure has been due in part to a number of faults seen in certain of these droppers for multi-dose use by the patient. A few of these objections perhaps should be mentioned.

1. The patient cannot see the contents of the dropper bottle.
2. Minute amounts of plastic (splinters) might fall into the solution if the screw-portion of the bottle (for the cap) is not properly manufactured.
3. Older patients might have great difficulty squeezing these bottles to instill a drop into their eye.
4. The tip of the dropper may become contaminated.

DRUG-PLASTIC INTERACTIONS

A number of uses for plastics in various aspects of medical practice has been reviewed, but many more reports could have been included had time or space permitted, since there is quite a voluminous selection on this subject in various medical journals. Untoward and toxic reactions to plastic, even though their citation is more limited in literature, can also be found if one attempts a thorough search of the literature. Quite different, however, is the case of information relating to drug-plastic interactions. Perhaps this is not really too surprising if one reflects for a moment that invariably a pharmaceutical manufacturer tests his products with the plastic container or device before he releases it to the open market. If a reaction

occurs then that plastic material is discarded or the drug formula is reformulated. This type of information, of necessity, is restricted and invariably will not appear in any publication. As does occur at times, to the embarrassment of the pharmaceutical company, an incompatibility may occur after the product is already on the shelf of a pharmacy. More likely than not, this information finds its way into some published report but, as valuable as this information may appear to be, it is not a well-documented source of information and may even be quite misleading since many other factors could have contributed to the incompatibility besides the plastic container or device.

The paucity of data concerning drugs and plastics in contact with each other is, in part, due, as has been mentioned, to the secrecy the pharmaceutical industry places on this type of information. Even less help in this matter has come from the plastic industry which is not quite aware of the importance of drug-plastic interactions to the general welfare of the patients in a hospital. This lack of general available information is probably the reason for the general present feeling by many in hospital practice that one should not really expect an incompatibility between a drug product and a plastic material. As will be shown shortly, this optimistic view may be quite deceiving and the hospital pharmacist should become alert that incompatibilities can and do occur. This, in no way, detracts from the excellent advantages which plastics offer to medicine and pharmacy, but rather it attempts to prevent or circumvent the disadvantages or problems which can occur.

Types of Drug Plastic Interactions

For the past four years, our group has become interested in drug-plastic problems from three points of view: First from a public health aspect, second, from an academic, and third, from a developmental point of view. What is to follow relates primarily to the public health aspect.

In a previous paper,[41] drug-plastic interactions were conveniently discussed under three separate groups. This arrangement still appears to be functional and for this reason, we will continue with the same groupings but will expand the discussion to include recent developments which have not appeared in the literature. The three groups thus are:

1. Leaching or Migration
2. Chemical Reactivity
3. Binding

Undoubtedly, no matter how thorough one attempts to be in covering a subject, a number of points will be missed or for one reason or another will be left out. Much of the information to be presented is from our own laboratory, but other sources of information have been extracted from other fields. The hospital pharmacist, himself, may even be aware of interactions not known to our own laboratory, for which we would certainly appreciate his observations.

Leaching or Migration

It has already been pointed out that a number of plastic materials to be serviceable must contain other ingredients. In this section, leaching will mean the release of a constituent from the plastic to its immediate environment (*i.e.*, solution) or transmission of an ingredient from the contents of the plastic device to the air. If the immediate environment is a drug solution, then the rate of migration will be dependent on a number of factors such as the solvent system, solute or solutes, the *p*H, time of contact and temperature. To illustrate how some of these factors may influence migration, a number of actual experiences will be related.

Migration into a Solution - Effect of Solvents

In one study on plastic tubings recommended for medical use, every polyvinyl chloride tubing tested released a constituent from the tubing to a solvent system consisting of 50 percent or more of alcohol, propylene glycol and polyethylene glycol.[42] Many of these solvents are vehicles for parenteral products. The leaching, however, cannot be noticed or detected by visible means and, consequently, if this tubing is used to administer a drug or nutritional product, it seems quite likely that the "leached" constituent is also introduced into the patient. A polyethylene tubing (no additives) did not show any incompatibilities with the same solvents.

Mention should also be made that even polyethylene (pure) may release micro-quantities of an organic constituent to distilled water stored for a long period of time in polyethylene bottles. Delhez[43] has noted this in one of his reports. At the moment it appears doubtful if this micro-quantity of leached constituent would influence in any manner the stability of a drug product, but it is well to be aware of such an interaction in case of any "unexplainable" reaction.

A number of plastic tubings and devices are colored with an approved dye, and it is not too uncommon that these dyes will migrate to solutions containing alcohol and other polyhydroxy solvents. This has been noted in our own laboratory as well as in other laboratories.

Already reference has been made to the fact that a pure polymer may release micro-quantities of an organic compound to water. There is still another remote possibility where pure plastic materials are concerned. One parameter for identifying a particular plastic material is to give the average molecular weight for the substance. Now it is possible for two samples (from different sources) of the same material to have

HAND LOTION
SHAKE WELL BEFORE

identical average molecular weights, yet one may react slightly different from the other. This may be due to the molecular weight distribution of each, one having proportionally more fractions of the monomeric molecules and lower molecular weight polymers in comparison to the second sample. These monomeric and low molecular weight molecules can more easily migrate into a solvent system. No one has yet speculated on what effects these constituents may have on a drug system if they do leach into a drug solution.

Plastic hubbed needles may be constructed from one of a number of plastic materials. Probably the most successful needles have been made with a hub composed of polystyrene or polymethyl methacrylate. Very little problem might be anticipated with this type of needle due to the plastic, since the total surface area exposed to a drug solution is at a minimum. However, there is the possibility of a reaction occurring even here if the drug product contains a solvent which will attack the polymer. One example of this was found in a study on polystyrene hubbed needles when Erythromycin I.M. Injection containing the solvent, diethyl carbonate, was kept in contact with the hub.[46] The plastic dissolved. This, no longer, is a problem with this particular injection, since the diethyl carbonate has since been eliminated.

Certain experiments and developmental work are now in progress in several laboratories to develop a plastic cannula which can replace the usual metal one. Here again, each drug product must be tested with the needle in order to insure that no reactions will occur.

Even though a solvent has or may have a very appreciable influence on the leaching of an additive from a plastic material, there is no doubt that a solute in a solvent can also exert some influence on migration. To test this thesis in a qualitative manner, we conducted a sorption study on a polyvinyl chloride tubing in contact with various organic solutes in water. These organic compounds were selected as representative of various structures appearing in medicinal agents. Since this information has not been previously published the actual experiment is presented here in its entirety.

Sorption Studies

Sections of polyvinyl chloride tubing having a length of 7 cm. were dried for 24 hours in a constant temperature oven regulated to 50°± 1° C. Each length of tubing was weighed and placed into a five dram, screw-capped, glass vial. Twenty ml. of the desired solution was added to the vial, the vial capped and placed into a constant temperature water bath at 25°± 0.1° C. At appropriate time intervals extending for 28 days, the vial was removed from the bath and the specimen withdrawn. The tubing was blotted with lint-free cloth, dried by the use of compressed air and weighed. Immediately after the weighing, the tubing was placed back into the vial. Enough solution was added to maintain the original volume and the vial placed into the water bath. This procedure of drying and weighing was standardized and could be performed within three minutes of withdrawal of the vial. Triplicate specimens were used for all determinations.

Twenty-six solutions were employed in these studies. Solutions were prepared to have a strength of one percent (w/v) or (v/v) or, if the solubility was below one percent, then saturated solutions were prepared. In each instance, freshly prepared distilled water was used as the solvent. The organic compounds were of C.P., U.S.P., or N.F. grade, depending upon the availability of the chemicals at the time of preparation of the solution.

Table 1 summarzies the results of the sorption study. As may be seen by examining the table, the organic compounds exerted, to various degrees, an influence on the sorption of the solutions by the polyvinyl chloride tubing. Certain of the compounds exerted an unusual effect on increasing sorption. For example, benzaldehyde increased sorption up to 12 percent within the first two hours. After three days of contact with the diethylaniline solution, the tubing had gained approximately 20 percent in weight. Aniline exerted a 7 percent increase in weight within three days, while m-cresol, benzoic acid and phenol each contributed approximately a 5 percent increase in weight after the same period of immersion.

No attempt was made to treat theoretically the results obtained in this study in order to establish what effect the structure of the various organic compounds had on sorption. To do such an interpretation would require further experimentation and on many more compounds. Pinksy[44] has, however, shown that the structure, the polarity, and the shape of the molecules will influence the penetration of the compound into the plastic material.

In this study, it was noted that the higher sorptions were caused by compounds containing aromatic rings, while the aliphatic type compounds exerted the least influence. But as can be deduced from the table, certain aromatic substances (resorcinol and thimerosal) had little effect upon sorption in comparison to the other aromatic type compounds.

According to the theory of Taylor and Kemp,[45] a linear relationship will exist when a plot is made of the log of the percent water sorbed *versus* log of time of immersion. A break in the curve would indicate that one or more soluble constituents has been released from the rubber.

When the sorption data of the 26 solutions were plotted as above, a linear relationship did occur in the initial stages of sorption, but a break did occur in most instances from the third to the seventh day. From this period up to one month, the curves ap-

proached a slope of approximately zero. The sorption of water alone followed a straight line up to a period of two weeks and then a break occurred.

The sorption study revealed that certain constituents from the plastic, polyvinyl chloride, were appearing in the solutions, but unfortunately, the magnitude of "leaching" could not be discerned.

At the end of one month, desorption was initiated and these results also appear in Table 1 under the heading of "24 hr. loss on drying." Six of the compounds, diethylaniline, m-cresol, phenol, triethylamine, diethylamine and acetic acid produced a loss of 2 percent weight of the tubing from the original weight. These results indicated that leaching had occurred during the 28 day period of immersion to the various solutions.

TABLE 1. Sorption of Solutions by Polyvinyl Chloride Tubing Stored at 25° C.

	Percent Sorption* Time										
	2 hr	6 hr	12 hr	24 hr	3 da	7 da	14 da	21 da	28 da	24 hr loss on drying	Comments
Water	0.20	0.24	0.28	0.28	0.44	0.59	0.53	0.53	0.52	0.60	
Benzaldehyde	12.40	16.05	16.58	16.40	16.09	15.31	14.50	13.73	13.11	none	tubes swelled
Diethylaniline	7.97	15.35	17.73	18.35	19.15	19.55	20.20	20.55	20.37	2.00**	tubes swelled
Aniline	4.57	7.12	7.53	7.44	7.62	8.47	8.50	8.55	8.29	none**	
m-Cresol	2.40	3.90	4.50	5.10	4.90	4.20	3.80	3.50	3.00	2.20**	difficult to dry
Benzoic Acid	1.35	3.12	3.87	4.44	4.78	4.93	5.00	4.76	4.76	none	
Phenol	1.70	3.19	4.23	4.69	4.78	4.65	4.59	4.52	4.28	3.12	difficult to dry
Triethylamine	1.46	2.36	2.62	2.77	2.82	3.04	3.50	3.87	4.20	2.63	tubes turned purple on drying
Diethylamine	0.80	1.28	1.54	2.36	2.61	3.18	3.33	3.05	2.69	2.73	tubes turned brown on drying
Ethyl Acetate	2.30	2.87	2.98	3.01	3.14	3.20	3.12	3.01	2.96	0.50	
m-Nitroaniline	1.01	1.55	1.76***	2.25	2.36	2.48	2.45	2.28	2.28	none	tubes stained bright yellow
2-Butanone	1.15	1.43	1.54	1.60	1.74	1.80	1.72	1.67	1.67	0.57	
Pyridine	0.90	1.19	1.26	1.44	1.54	1.63	1.72	1.60	1.60	0.80	turned brown on drying
Butyl Alcohol	0.74	1.00	1.00	1.10	1.22	1.30	1.38	1.30	1.20	0.40	
Benzamide	0.46	0.73	0.88	1.08	1.38	1.50	1.52	1.47	1.47	none	
Resorcinol	0.43	0.59	0.67	0.98	1.24	1.21	1.25	1.23	1.16	none	
Propionic Acid	0.33	0.54	0.68	0.74	0.95	1.10	1.07	1.11	1.11	0.55	
Sec-Butyl Alcohol	0.38	0.65	0.70	0.75	0.85	1.05	1.05	1.03	0.98	0.58	
Acetic Acid	0.24	0.27	0.36	0.43	0.67	0.83	0.97	0.84	0.86	2.93	
Phthalic Acid	0.24	0.34	0.40	0.52	0.71	0.85	0.90	0.96	0.89	0.48	
Acetone	0.48	0.64	0.64	0.71	0.74	0.94	0.91	0.86	0.84	0.64	
Merthiolate	0.26	0.31	0.35	0.41	0.64	0.83	0.80	0.89	0.89	0.11	
Oxalic Acid	0.22	0.29	0.33	0.45	0.59	0.74	0.80	0.77	0.85	0.38	
Tert-Butyl Alcohol	0.31	0.42	0.47	0.49	0.62	0.71	0.77	0.70	0.70	0.54	
Acetamide	0.21	0.22	0.25	0.33	0.52	0.59	0.58	0.58	0.53	0.69	
Citric Acid	0.18	0.15	0.15	0.13	0.11	0.19	0.17	0.19	0.19	0.90	

*These values are the average for three specimens.

**It was evident that further drying would cause greater weight loss.

***This tube was weighed after 48 hrs. instead of 24 hrs.

TABLE 2. Injections or Solutions Found Incompatible With Plastic Syringes[47]

Injection or Solution	Contact Time	Results
Paraldehyde Injection	up to 5 hours	dissolves polystyrene no effect on polyethylene or nylon
Poliomyelitis Vaccine*	up to 5 hours	change in color of solution with all three syringes
Dimercaprol Injection**	up to 5 hours	no effect on any of the three types of syringes
	after 12 hours	etching and clouding of internal surface of polystyrene but no effect upon polyethylene or nylon
Benzyl Alcohol	up to 5 hours	dissolves polystyrene but no effect upon polyethylene or nylon
Benzaldehyde	up to 5 hours	dissolves polystyrene but no effect upon polyethylene or nylon
Benzyl Benzoate	up to 5 hours	dissolves polystyrene but no effect upon polyethylene or nylon

*Color change due to slight alteration in *p*H.
**The solvent effect was due to the benzyl benzoate in the injection.

The introduction of a new solvent to pharmaceutical practice often may produce a problem with plastics. For example, one company has envisioned the use of dimethylacetamide as a solvent for a certain steroid. This product in a nylon syringe or container will play havoc with the nylon, dissolving the polymer.

Migration or Transmission of a Constituent

A number of pharmaceutical, cosmetic and medicinal products contain one or more volatile ingredients which may migrate through the plastic walls of a container or device leaving the solution deficient in that ingredient. Perhaps the greatest concern in this problem is by the cosmetic people who have found that a few plastic materials cannot be used for certain of their products. Pinsky[44] has studied the permeability of a host of organic compounds through polyethylene and his results support his contentions that size, shape and polarity play a very important role in the penetration phenomenon. For example, he found that the transmission rate would increase in approximately the order of

Alcohols - Acids - Nitroderivatives - Aldehydes - Ketones - Ether and Hydrocarbons

One must not forget that the solvent can also migrate or penetrate the plastic material and depending upon the specific plastic, a drug product stored in a plastic bottle may give off water or other solvents increasing the concentration of the active ingredient in the preparation. This is well-known to hospital pharmacists who store large quantities of drug solutions in a polyethylene bottle for a long period of time.

Chemical Reactivity

Since the composition of plastic materials can vary to such a large extent and, since drug products are also composed of an unlimited number of ingredients, it should not be too surprising to think that an incompatibility may occur when a particular drug product is in contact with a specific substance. It is a tribute to plastics, as a whole, that even more incompatibilities of this type do not occur.

Chemical reactivity implies that an agent in the drug product has chemically reacted with a polymer or one of the additives in the plastic. Under this same heading, it will also include any degradation of an ingredient in the drug product caused by transmission of vapor and/or other gases through the plastic into the drug system. Three plastic devices (syringes, tubings and containers) will be reviewed where chemical reactivity was observed.

Plastic Syringes

In a series of studies on three types of plastic syringes, and several hundred drug products, a limited number of incompatibilities were observed with the test procedure used.[47] The solutions were kept in contact with the syringes for a period of five hours, in the dark and at room temperature and were then evaluated as to the presence of an incompatibility by using three parameters:

1. Changes in physical appearance of the plastic as well as the appearance of the solution.
2. Changes in *p*H of the solution.
3. Changes in nephelometric readings.

These incompatibilities are shown in Table 2. It should be pointed out here that at times the active ingredient may not be the ingredient causing the incompatibility, but rather one of the other agents in the solution may be the culprit. For example, Dimercaprol Injection gave an incompatibility, but on further analysis, it was found that the benzyl benzoate in the injection caused the etching of the polystyrene. In none of these tests was there any actual analysis of the active ingredient to see if there had been a reduction in potency of the product. Longer periods of contact such as would be customary in plastic containers might reveal many more incompatibilities than could be observed within a five-hour period.

Recently, polypropylene syringes have appeared on the market. These syringes would appear to have certain advantages over the polyethylene since they can

be sterilized if this is desired. In a recent study, our laboratory tested polypropylene to be used as syringe barrels with 48 injectable products selected at random. The tests were performed as reported above. No incompatibilities were found with the drugs used. Table 3 includes the injectable products tested. This information is included here since no data on polypropylene with drugs have been published.

TABLE 3. Injections Tested and Found Physically Compatible with Polypropylene*

Amethone	Magnesium Sulfate
Aminophylline	Mixed Weeds
Atropine Sulfate	Nembutal Sodium
Bal	Old Tuberculin
Benzaldehyde	Paraldehyde
Benzyl Alcohol	Pen Aqua
Benzyl Benzoate	Picrotoxin
Bevidox	Pitocin
Caffeine and Sodium Benzoate	Poliomyelitis Vaccine
Coramine	Polycycline
Cortril	Pronestyl
Desoxyn HCl	Quinine and Urea HCl
Dihydrosteptomycin Sulfate	Sodium Iodide
Diogyn	Sodium Morrhuate
Emetine HCl	Sodium Para-aminohippurate
Epinephrine HCl	Sodium Salicylate with Iodide and Colchicine
Estrone	Sulfadiazine Sodium
Flo-Cillin Aqueous	Testosterone
Folvite	Theelin in Oil
Gluco Calcium	Thiamine HCl
Heparin	Tubocurarine Chloride
Hexestrol in Oil	Vancocin
Histamine Phosphate	Vasoxyl HCl
Liver Injection	Xylocaine HCl

*12 hours contact

Plastic Tubings

Tubings seem to present the most problems when they are in contact with drug products. Of course, if the contact is for a very short period of time—say in minutes—then obviously there might be no detectable incompatibility. Very few flexible tubings can be made (perhaps with the exception of polyethylene) without additives. A past report[41] showed that a number of incompatibilities could be visibly detected if certain drug products were kept in contact with polyvinyl chloride tubing for a period of 12 hours. A summary of these incompatibilities may be seen in Table 4. A rather interesting aspect of this particular study was that even though one or more polyvinyl chloride tubings did reveal an incompatibility, other polyvinyl chloride tubings did not show such a tendency. This once again points to the problem which becomes compounded when various manufacturers make the same generically-named plastic, since one tubing from one company may act quite differently from the tubing of another company, yet both may be called polyvinyl chloride tubing.

Anomalous results may, at times, be seen when two drug products under the same generic name but prepared by two different manufacturers are used in an experiment. For example, one Sodium Iodide Injection turned yellow while in contact with a polyvinyl chloride tubing while another Sodium Iodide Injection (from another company) did not when in contact with the same tubing. Further investigation on this reaction showed that the injection, which did not turn yellow, had an antioxidant (sodium meta bisulfite) in it.

Containers

Two important problems may be noted when plastic containers are to be used. One of these may involve a direct chemical reaction between the plastic and the drug product, while a second may be the transmission of oxygen or carbon dioxide through the container into the drug solution. Invariably, these reactions are not noted usually until the product has been stored for fairly long periods of time. However, this does not mean that the reaction was not occurring even in the early phases of storage. At present, the gas transmission problem has probably caused the most incompatibilities. Any drug sensitive to oxidation will not last long in most plastic containers. The usual polyethylene containers have a fairly good transmission rate and unless a protective coating is placed inside the container, oxygen is going to enter and oxidize the ingredient. Many examples of this can be seen. Who has not noticed nose drops containing vasoconstricting agents turning brown and forming a precipitate when stored in a polyethylene squeeze-type bottle? Certain antibiotics have been oxidized or degraded in some other way when kept in polyethylene bottles. Taste of solutions have changed when they are kept in plastic containers. It has already been pointed out in an earlier section of this paper, that transmission rates can be reduced if high density polyethylene is used or if a special coating of another polymeric material is applied to the plastic. These innovations, however, will increase the cost of the container and may present some other problems not foreseen at this time. Polypropylene appears to be slightly better in this respect than the polyethylene of any density variety.

Poorly formulated products might suffer much more in certain plastic containers than in a conventional glass container. This has been noticed for ingredients which are either weak organic acids or organic bases and which, of course, are dependent on *p*H for solubility in water. One example of this problem may be related. A certain sulfonamide was prepared in a 25 percent concentration using the salt. This was stored in a conventional polyethylene bottle for a period of one to two months. On examination of the solution, a light precipitate was noticed which was further identi-

TABLE 4. Examples of Incompatibilities* of Polyvinyl Chloride Tubings with Parenteral Products[41]

Parenteral Product	Description of Incompatibility
Benzyl Benzoate	Tubing dissolved
Compazine	Solution developed a color
Decholin Sodium	Solution developed a color
Liver Injection	Solution became lighter
Poliomyelitis Vaccine	Solution became lighter
Procaine HCl	Tubing stained a yellow color
Pronestyl HCl	Tubing stained a yellow color
Sodium Iodide	Tubing stained a yellow color
Sodium Lactate	Solution developed a color (varied with the type of tubing)
Sodium Para-Aminohippurate	Solution developed a color

*Incompatibility tests were conducted on a number of polyvinyl chloride tubings having various formulas. The tubing was kept in contact with a parenteral product for a period of 12 hours. Both the tubing and the solution were then examined for any changes. Physical appearance, *p*H changes and nephelometric values were recorded and used as the parameters for the tests. It should be noted that some tubings showed no incompatibilities with a particular parenteral product.

fied as the acidic form of the sulfonamide. The *p*H was also checked and found to have decreased slightly. A fairly good assumption was made that carbon dioxide from the atmosphere had entered the solution through the container reducing the *p*H and precipitating the drug. Here a delicate change caused the incompatibility which probably would not have been seen in a glass container for the same period of storage.

Certain compounds will stain plastic materials. Mention has already been made to this in regard to polyvinyl chloride tubing (see Table 4). Iodine solutions will discolor olefinic polymers after a short period of contact. Certain solutions containing a dye may also give some coloration or changes in hue of the plastic. The introduction of colored plastic containers has added some new problems since on long contact with certain drug products, the color of the plastic fades or becomes spotty.

The aerosol people have found that fluorinated hydrocarbons will attack polystyrene, polyethylene and most vinyl polymers while having little effect on Bakelite, nylon-6, nylon-66, Saran and Teflon. Brown[48] reported that the attack on plastics is decreased as the number of fluorine atoms are increased in the fluorocarbon molecule.

Oils and hydrocarbon compounds such as petrolatum are not suitable to be stored in polyethylene or vinyl containers. After a short period of storage they migrate to the surface of the container and soften the container to such an extent that the container no longer is functional. Formulation of an oil-in-water emulsion will make it possible to use these containers—providing that a good stable emulsion can be created. Even with the use of an emulsion, there may be the possibility of the emulsifying agent migrating to the polymer, thus reducing the emulsifying ability. No real research has been conducted in this area, however, and what is said may be more speculation than fact, but it appears possible on theoretical grounds.

Pinsky, Nielsen and Parliman[49] in one investigation studied 67 typical chemicals in polyethylene bottles as to permeability, effect on plastic and effect on the chemical. Their conclusion based upon their results indicated that polyethylene compared very favorably in many ways with glass. However, one should be cautious not to extrapolate these results to drug systems without first testing the drug with the plastic.

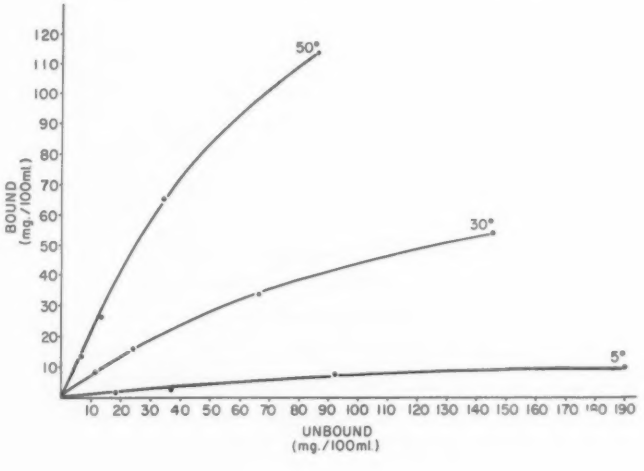
There is, at present, a desire by many hospital pharmacists to change over from ointment jars to plastic containers. Certain reactions may occur in the plastic container which will not be seen in glass. Since there are a variety of ointment or cream-like products on the market, or which can be compounded, it would be wise to first test the ointment with the specific plastic material. At times, a constituent in the ointment may act as a solvent, softening the plastic and thereby reducing its protective influence on the product. For example, Roche Laboratories cautions that its Asterol Ointment, Triburon and Triburon Hydrochloride Ointments should not be placed into styrene, nitrocellulose or cellulose acetate containers since polyhydric alcohols such as the Carbowaxes will soften these plastics.* This will not occur when stored in other types of plastic containers.

Binding

The structure of a variety of polymeric substances would indicate that possible intermolecular reaction

*Carbowaxes are in the ointments.

Fig. 1. Binding of sorbic acid by nylon syringes[50]



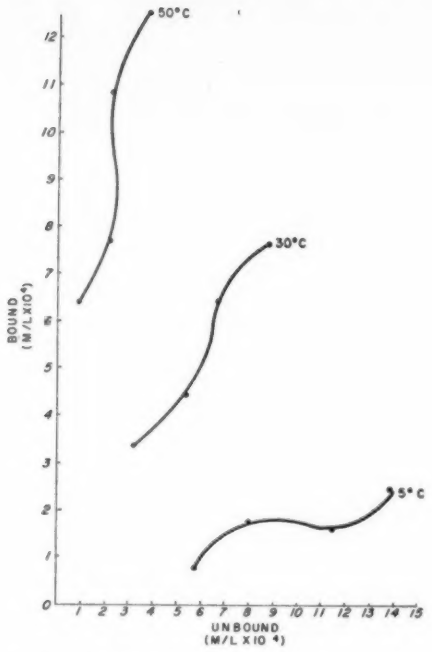


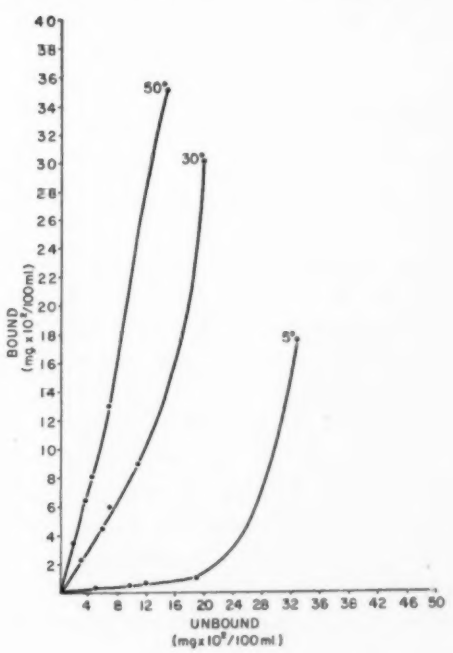
Fig. 2. Binding of benzoic acid by nylon syringes[51]

might occur with drugs possessing certain physicochemical properties. The uptake of the drug by the polymeric material would then result in a reduction of the potency of the drug product. Binding (or adsorption) would be favored if the polymeric substance had charged negative or positive centers which could then attract drug molecules having opposite charges. Nylon is a good example to consider since the polymer contains recurring amide groups. The carbonyl group, in the amide, takes on a partial negative charge which can then attract a molecule having a protonic group, such as exists in weak organic acids and phenols. Secondary valence forces could then strengthen the binding.

Our interest in binding developed when our laboratory was engaged in evaluating nylon syringes. A series of experiments indicated that a number of drugs having acidic functional groups would be taken up or bound by the nylon syringes. In these studies, several different concentrations of a drug solution were placed into the barrels of nylon syringes or into nylon tubes, and these were stored for a period of 48 hours, at which time they were assayed for drug content.[50,51] The data were then plotted as bound drug *vs* unbound as may be seen in Figures 1 and 2. An analysis of the figures would then give some mild insight as to what was occurring. Sorbic acid (Fig. 1) is taken-up in a rather smooth manner showing that the migration of the drug solution through the matrix is not being hindered to any great extent. The S-shaped curve for benzoic acid (Fig. 2) shows another pattern of uptake. The drug is not bound in a smooth manner but in spurts. It appears that within certain concentration ranges, benzoic acid has little difficulty reaching the binding sites; however, once these binding sites are filled, there is a temporary halt to binding. Binding begins again when new binding sites become available as the solution diffuses through the matrix of the plastic. Phenol presents still another type of binding (Fig. 3). Here, relatively little binding occurs at the lower concentrations, but a concentration level is reached where a sudden increase in binding is noted. The explanation for this unusual result is that phenol in a sufficient concentration will alter the structure of the nylon, causing a stretching of the chain which, in turn, permits a surge of solution to enter a region of the polymer matrix containing new binding sites. In each case, an increase in temperature gave an increase in the up-take of the drug.

Even though surface adsorption does take place, it is improbable that up-take of a drug would be significant by this route alone. Theoretically, this reasoning appears to be sound since a careful examination of the spacial structure of the polyamide would indicate that there would be relatively few binding sites (amide groups) to attract and hold the drug molecule in comparison with the overwhelming number of free drug molecules in the solution. In other words, only a relatively few drug molecules at any one moment can find binding sites at the surface of the nylon. Experiments, qualitatively at least, support this thesis. For example, if a very thin sheet of nylon is placed in contact with a drug (known to be bound) and after equilibrium is reached, a small but definite quantity of the drug will be removed from the solution. Now, if the thickness of the nylon sheet is increased (keep-

Fig. 3. Binding of phenol by nylon syringes[49]



ing surface area exposed to the drug solution the same) much more of the drug is removed from the solution. If this procedure is continued (increasing thickness of nylon) a point will be reached where all of the drug will be removed from the solution.

An experiment was performed to find the quantity of a drug bound after equilibrium was reached. For this particular experiment, thin sheets of nylon (0.125 in. thick) were immersed in 0.01 percent W/V solution of sorbic acid in an all-glass tube.* These tubes were placed into water baths for a period of several months at three different temperatures. It was found that equilibrium would be reached within four to five weeks and the amount of uptake per gram of nylon averaged 5.3 to 5.5 mg. of sorbic acid. The effect of temperature on the uptake of sorbic acid may readily be seen if percent uptake (binding) is plotted against time (Fig. 4).

Other factors also undoubtedly influence the binding of a drug to a plastic material. For example, *p*H plays a very important part in the binding phenomenon as may be witnessed by referring to Fig. 5.[52] Here, various sorbic acid solutions have been buffered to a definite *p*H and the binding determined after a period of six days. At the very high *p*H, no binding was noted but as the *p*H was lowered, binding increased. This would indicate that primarily it is the non-ionic form of the sorbic acid which is bound while the ionic form has little tendency for binding. Since the carbonyl groups in the nylon have negative charges, the negative sorbate ion would be repelled from the binding site. A closer examination of the data (not presented in detail in this paper) would, however, show that some binding of the ionized sorbic acid was bound to the nylon. Changes in the *p*H of the solution can also alter the "charged" character of the nylon and this may create positive centers which would then attract the sorbate ion.

If less polar solvents are included in the solution, there is a decrease in binding. Other solutes will either increase or decrease the binding.[52]

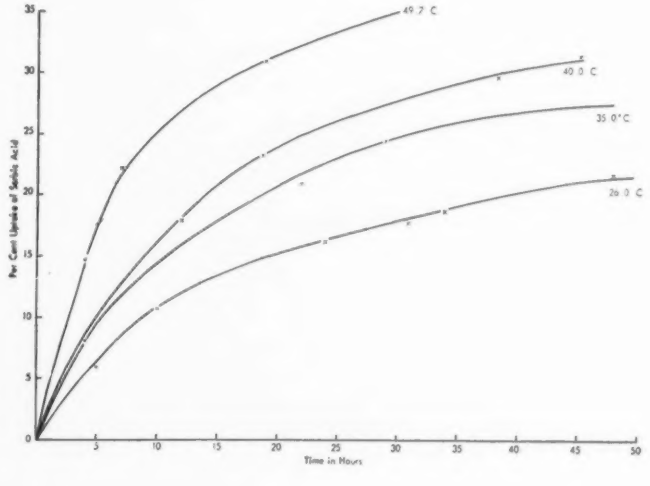
Compounds which were bound by nylon syringes are shown in Table 5. Not all compounds having acidic hydrogens will be bound by nylon. In our studies, we could not detect binding of chloramphenicol, barbital, phenobarbital and aspirin. A change in structure of a compound may completely abolish binding. Salicylic acid is bound to a very high degree, but when the hydroxyl group is esterified to give aspirin, no binding occurs. Spacial configuration of the drug molecule must thus be considered as still another factor in the very complex phenomenon of drug binding.

In textile reports, considerable information is available on the binding of both anionic and cationic dyes with synthetic yarns including nylon. Unpublished reports, brought to our attention, have indicated that certain cationic agents may even be bound or adsorbed by polyethylene and other plastics not known for their binding ability. Unfortunately, these have not been verified in any manner, and are just presented to show you what may happen with plastics. There is, at present, no system which will predict which drug will be bound or which drug will not be bound.

To demonstrate this unpredictability, reference will be made to our efforts to apply a silicone coating on the nylon syringes to eliminate the binding. The thought, of course, was to have a layer of silicone which would prevent the diffusion of the drug solution into the matrix of the nylon. A series of experiments, however, showed that it was impossible to get an even coating since the silicone was also diffusing into the nylon. This information was brought to the attention of the silicone manufacturers, but no help was forthcoming on how to solve the problem.

*Evaluation of diffusion constants and activation energies of sorbic acid, as well as other drugs in nylon, will be published in the future elsewhere.

Fig. 4. Uptake of sorbic acid (0.01%) by nylon at different temperatures



Present Problem - Need for Standards for Plastics

It is rather surprising that the number of drug-plastic incompatibilities which have and can occur, as well as the potential hazards to the patient (even though these may be relatively few), has given little concern to the plastic industry or the companies manufacturing plastic devices for pharmaceutical or medicinal use. There are, of course, a number of highly ethical firms who manufacture and distribute plastic devices which have been adequately tested but for each of these, numerous "small operators" are entering the field utilizing the reputation of the established firms. This in no way condemns the small firm which is also conscientiously pursuing quality products, but lack of know-how and adequate personnel can hamper its operation without, perhaps, the management really

being aware of the potential problem. The real threat comes from the marginal operator literally setting up shop in his garage and then competing with the firms producing quality items.

The question may, thus, be asked: How can this be possible? A very simple and straightforward answer can be given. There are no real standards for plastics to be used in pharmacy or medicine. Each firm establishes its own testing methods or no testing methods at all. It may be true that the manufacturer or distributor points out that the ingredients in the plastic material are F.D.A. approved, but this also can be misleading. F.D.A. approval usually refers to the plastic ingredient when used in food packages. A drug system is quite different than a food product and many more possible interactions can occur with drugs than with food. A specific leaching tolerance established for, say, a plasticizer in a food package may be quite safe, but will a larger concentration leached into a drug product be as safe? In many instances this information is still not known.

The F.D.A. is cautiously looking at this potential problem, but as yet has not intervened. If some form of standards is not formulated in the near future, the government might have to step into the picture. The World Health Organization and the U.S.P. are also showing concern and are now studying the problem. Our own laboratory is receiving inquiries from various parts of the country as well as from other countries as to our recommendation for this or that plastic material. Unfortunately, in many instances we cannot give concrete information since much more drug-plastic research and testing must be conducted before a final answer can be given. At the moment, the most that can be said is that each product must be tested with each plastic device. There is hope, however, that in the future plastics may conform to certain standards before they can be employed for devices to be used in pharmacy and medicine. In this regard, our laboratory, with the help of Dr. Lee Worrell, Professor of Pharmaceutical Chemistry, and Dr. Wallace Guess are now engaged in studying testing methods which might be suggested for formulating minimum standards for plastic materials. The road is not a simple one and will require a great deal of support if success is to be achieved, not only by our group but by other groups throughout the country.

TABLE 5. Agents Which Were Bound by Nylon Syringes - Expressed as Percent After One Week of Contact[41]

4-Chloro-3methylphenol	85.5
Propylparaben	85.1
Salicylic Acid	80.1
Parahydroxybenzoic Acid	78.7
Methylparaben	75.5
Benzoic Acid	67.1
Phenol	60.5
p-Aminobenzoic Acid	51.0
Sorbic Acid	47.0
m-Hydroxybenzoic Acid	39.5

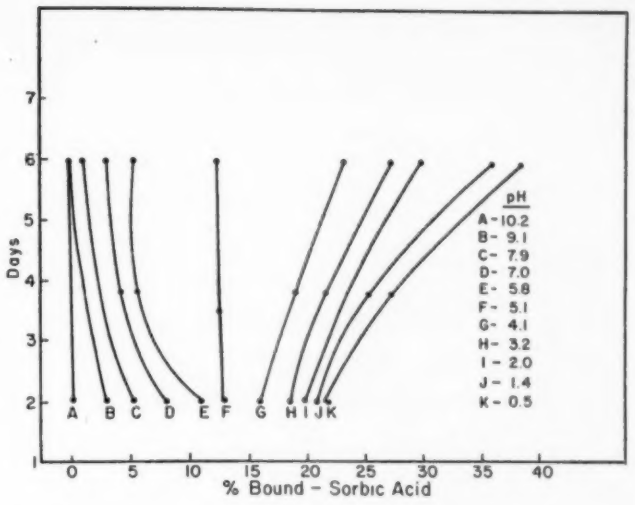


Fig. 5. Effect of pH on the binding of sorbic acid (0.1%) by nylon[42]

PRESENT GUIDE TO HOSPITALS IN SELECTING PLASTIC DEVICES

Since there are no real standards for plastics to be used in pharmacy and hospitals, the hospital pharmacists, or those in authority to make decisions on the purchase of items, must take on the responsibility of evaluating the merits of one item over the other. The hospital pharmacist with his background in the physical, chemical and biological sciences is in a very favorable position to exert his influence in these matters. Perhaps the first step he should initiate (if there is not such a committee) is to suggest that a hospital Committee on Plastic Standards be established to discuss the problems currently existing with plastic and drugs, as well as with the uses of plastics as prosthetics or any other uses where the plastic will have contact with skin, tissue or organs. As has been pointed out in this paper, considerable information has appeared in the past on reactions caused by plastics in animals and humans, but some of these data are not very valid since better plastic materials have evolved. There should be actual data concerning tissue reactivity and toxicity studies on the actual plastic device which is to be used on or in the patient. One cannot condone the use of any plastic device if this aspect of testing has not been performed. If the plastic device is to be in contact with a drug product or drug products, there should be some proof that an interaction will not occur.

In order to help the hospital pharmacist to judge or evaluate plastic devices or to help the committee to organize its approach to the problem, the following guide is suggested on what information might be of value in making a decision as to the acceptance or

rejection of a plastic device. The guide is just a suggestion and is very general, so can be used with considerable latitude depending upon the needs of the hospital.

A Guide for the Evaluation of Plastic Devices to be used in the Hospital*

I. GENERAL INFORMATION NEEDED FOR EACH DEVICE

1. Name of Device.
2. Manufacture or Distributor.
3. Address.
4. Generic Name of Plastic.
5. Trade-marked Name (if any) of Plastic.
6. Additives
   a. Name or Names of Additive,
   b. Quantity of each present,
   c. Whether F.D.A. approved for food packaging.
7. Sterilization of Device
   a. Whether purchased as a sterilized unit in a protective package or not.
   b. Method of sterilization for "a" above.
   c. If to be sterilized and packaged by hospital, method of sterilization and packaging.
   d. Disposable or re-useable.
8. Contact with Patient
   a. Site of contact and specific use.
   b. Time of contact.
   c. Exact procedure in placing or inserting device.
   d. Special feature of plastic device needed or not needed.
9. Contact with Drug Product
   a. Type of drug product or products which will come in contact with plastics (solid, solution, oral, parenteral, etc.),
   b. Length of contact,
   c. Storage condition.
10. Tests Performed
    a. Test for sterilization,
    b. Test for pyrogenicity,
    c. Test for skin and tissue sensitivity,
    d. Test for toxicity (both acute and chronic),
    e. Test for compatibility with drug products
       (1) Leaching of an ingredient into drug product,
       (2) Binding or sorption of a drug ingredient by the plastic,
       (3) Permeation of gases into drug systems through the plastic,
       (4) Permeation of ingredients from the drug system through the plastic,
       (5) Alteration of the potency of the active ingredient after contact with plastic,
       (6) Alteration of the physical and chemical properties of the plastic by the drug system.
       (7) Other tests.

Comments Concerning the Above Ten Points

A glance at the guide sheet will reveal immediately that much of the information must be obtained from the manufacturer or distributor. Essentially, the acceptance or rejection of the item will be based upon the information and evidence supplied by the source for the item.

*This includes all items (referred to as devices) which may be used in pharmacy or medical practice.

Points 1 through 5. These can readily be obtained without any real difficulty either from the literature of the distributor or from direct contact with the distributor.

Point 6. This will present problems since invariably names of additives will not be given. Even if the name is divulged, it probably will be as a trade-name and may not mean too much to the uninitiated. The knowledge that the additive is F.D.A. approved is of value, but it must be remembered that "approved" here means for a package to be used for foods—not for drugs. Perhaps the most useful information here is that there is or is not an additive.

Point 7. Depending upon the size of the hospital, there may be financial savings if items can be purchased without sterilization or packaging. The hospital might then decide to sterilize and package the item. Many of the plastic items will not withstand the usual sterilization techniques and consequently some other method must be used. Ethylene oxide appears to be the answer, but there must be assurance that sterilization has been achieved. For smaller hospitals or where labor costs are high, the sterilized, packaged items are probably the most suitable.

Point 8. A knowledge of the exact use of the plastic device in a patient can give an insight as to how rigorous the testing procedures should be to ensure the safety of the patient. This information may be gathered from the surgeon, attending physician, and nursing staff. Further advice from a bacteriologist, pathologist, histologist and pharmacologist is also advisable since they may have observed some unusual reactions when the same type of plastic device was used in one of their studies. Reports in literature may also throw considerable light on a specific untoward reaction.

Point 9. The information required for point 9 will be extremely valuable as shall be seen in a moment. Since solvents and drugs may interact with the plastic, a knowledge of what will be in contact with the drug and the length of contact as well as storage conditions should serve as a guide in predicting if there may be the possibility of an incompatibility. If only one product is to ever come in contact with the plastic and this for a short period of time—say less than an hour - then obviously the incompatibility hazard is reduced to the point where just one or two tests may give sufficient evidence to prove that the plastic drug combination is compatible. As more products are used for the same type of device, the potential hazard increases and there may be no real method for predicting incompatibilities until adequate testing is done. The distributor may or may not do this testing, but if he does, the information contained under point 9 will be an excellent guide on what type of testing should be performed. At the moment, there is no simple answer to this testing procedure. Be quite careful, however, on what the distributor says in regard to tests which have been performed. They may be quite legitimate but may not involve the products which will be used with the plastic device. Also ask for documentation that the tests have been conducted and what they entailed.

Point 10. Here are some of the tests which should be checked for from the manufacturer, distributor or within the hospital itself. Naturally, all of these may not be necessary for the acceptance of a plastic device. Most ethical firms will probably have performed tests "a" to "d" but it is quite doubtful that "e" (Stability Tests with Drug Products) has been conducted. Attempt to get the manufacturer to run these tests, or some private laboratory if funds are available. Of course, if the plastic is a pure polymer, one will not have to worry about a leaching test, or if the drug product is to have contact for a very short period of time with the plastic, permeation of gases (such as oxygen or carbon dioxide) may not be consequential to do any harm to the drug system. One cannot be too cautious, however, in regard to plastics and it might be prudent to have the active ingredient in the drug product assayed after contact with the plastic device under conditions of use.

Decision for Acceptance or Rejection

1. Acceptance or rejection of a plastic device should be dependent upon point 10 (Tests Performed). If none of these tests have been performed, then it would be wise to delay the acceptance of that particular plastic item. The support for the acceptance of an item will increase as more of the tests have been performed. Final acceptance or rejection must be left to the discretion of the hospital.

2. Actual testing data and the method of testing should be available or literature citation should be given showing that the work has been performed and published.

Summary

The rapid increase in the use of plastic materials in the field of pharmacy and medicine has been brought about by the unusual and seemingly unending properties which can be imparted to plastic, making them superior in many ways to existing materials. Unfortunately, there seems to be a feeling in certain circles that plastics are "safe" for all and any purposes. The lack of suitable standards for plastics to be used in pharmacy and medicine has just recently given concern to responsible clinicians, pharmacists, and public health officials.

Since the hospital pharmacist is in a very influential position to bring the problem of plastics to the hospital staff with the hope of establishing certain standards for plastic devices to be used in the hospital, it was felt that a general review of the subject would be valuable to the pharmacist in his professional role as a consultant to the hospital staff. The author has attemped to do this, recognizing of course, that many aspects of the subject have been inadequately or superficially covered.

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PREPARATION, ASSAY AND STANDARDIZATION OF ALLERGENS

by REGINALD W. LOWE *and* LEE F. WORRELL

► HOSPITAL PHARMACISTS IN THIS COUNTRY have generally overlooked the allergy clinic and laboratory as an important area for professional pharmaceutical service. In view of the widespread prevalence of allergy departments in the nation's hospitals, the pharmacist has an excellent opportunity to provide a service to the allergist which will be not only rewarding in professional recognition, but which will make it unnecessary for the hospital to purchase standardized commerical extracts at a high cost.

The purpose of this paper is to describe our experience in preparing, assaying and standardizing allergens at the University of Michigan Health Service. The laboratory in which these procedures are carried out is staffed only by pharmacists, and constitutes an integral part of the overall pharmacy operation. In addition to the procedures to be described, the pharmacists are also responsible for the filling of prescriptions containing these allergens which are written by the allergists. The procedure of filling these prescriptions will be described in detail in another article to follow.

There are two general classes of allergens prepared. One class, "Pollens," includes pollens from weeds, grasses, trees, etc. The other class, "Non-Pollens," contains all those allergens not included in the pollen category, such as the penicilliums, helminthosporium, aspergillus, etc. Both classes are extracted, assayed and standardized in essentially the same manner, the only difference being that 0.6 grams of sodium bicarbonate is added for each 30 ml. of diluting fluid used in the preparation of the pollen group.

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Dilutions Used

At the Health Service Pharmacy of the University of Michigan all allergenic extracts are assayed and then standardized to contain 20 mg.% of total nitrogen. Twenty mg.% represents 20/1000 of a gram of active material, i.e.: total nitrogen in 100 ml. of solution, or reduced to the smallest multiple 1/50 gram in 100 ml. of solution. This has long been referred to in our laboratories as a 1:50 dilution, a designation which a pharmacist, trained to express the concentration of dilute solutions in parts of solute per thousand parts of solvent (i.e. 1:1000 solution), might understandably find confusing. The two designations are not analogous in spite of the apparent similarity.

Extraction of Allergen Powders

Macerate a variable[1] amount of the dried and defatted allergen powder with a diluting fluid consisting of an aqueous solution of 5.0 percent dextrose and 0.5 percent phenol for a period of at least 72 hours with continuous shaking of the mixture for a minimum of 4 hours of this time. Keep the mixture in a refrigerator after the period of continuous shaking and continue to shake occasionally during the remainder of the time.

Remove from the refrigerator and filter through a fine grade of filter paper to remove the heavy precipitate. Sterilize the solution by means of a Seitz filter, which also removes any fine precipitate. This clear extract is then assayed.

Method of Assay

Since the assay of an allergen is based on the nitrogen content, a colorimetric assay following a Micro-Kjeldahl digestion is accomplished as follows:

Place in an N.P.N. (non-protein-nitrogen) tube calibrated at 35 ml. and 50 ml., a sample of the allergen (generally 0.1 ml. or 0.2 ml.), 1 ml. of digestion mixture (50 percent sulfuric acid), and 3 glass beads. Heat this mixture gently with a low-flame gas burner until the bubbling subsides. Cover the tube at this point with a small glass funnel, stem down, and continue heating with a high flame until all of the carbonized material is washed down the sides of the tube (a minimum of 3 to 5 minutes).

Cool to room temperature and add 8 drops of Superoxol (30 percent hydrogen peroxide). Boil the entire mixture for at least 1 minute to obtain complete decolorization and to completely decompose the excess Superoxol. Cool again to room temperature. Rinse down the funnel and insides of the tube with enough distilled water to make the volume approximately 30 ml., add 1 ml. of a 2 percent solution of gum ghatti and dilute the entire mixture to exactly 35 ml. with distilled water.

Prepare a blank containing 1 ml. of digestion mixture and 1 ml. of gum ghatti solution and sufficient distilled water to make exactly 35 ml.; also prepare a standard consisting of 1 ml. of digestion mixture, 1 ml. of gum ghatti solution and 3 ml. of a standard solution of ammonium sulfate (each ml. containing 0.03 mg. of nitrogen), with sufficient quantity of distilled water to measure exactly 35 ml.

Determine the mg.% of nitrogen of the extract colorimetrically according to the following procedure:

Add 15 ml. of diluted Nessler's reagent to each of the tubes prepared above (sample, blank and standard).

Stock Nessler's Solution[2]

Place 30 grams of potassium iodide and 22 grams of iodine in a 1000 ml. glass-stoppered flask. Mix well. Add 25 ml. of distilled water and 30 grams of redistilled mercury. Shake the flask vigorously for 7 to 15 minutes or until all of the iodine has nearly disappeared. The solution becomes quite hot. When the red iodine solution has begun to pale visibly, though red in color, cool under running water and continue shaking until the reddish color of the iodine has been replaced by the greenish color of the double iodide. Add distilled water to stop the reaction. Separate the solution from the surplus mercury by filtering and successive washings with distilled water. Dilute to 400 ml. This solution must be clear before it is used to prepare diluted Nessler's reagent.

Diluted Nessler's Reagent

Stock Nessler's Solution	150.0 ml.
10% Sodium Hydroxide Solution	700.0 ml.
Distilled Water	150.0 ml.

Allow the Bausch and Lomb Spectronic 20 Colorimeter to warm up for at least five minutes, set the wave-length scale to 425 millimicrons, and set the optical density scale to read infinity by means of the left hand dial. Transfer about 8 ml. of the blank solution to a 4-inch test tube and place it in the well of the colorimeter. Set the colorimeter by means of the right hand dial to read zero on the optical density scale. Retain this blank in this test tube to periodically reblank the colorimeter if needed when a series of samples is being assayed.

Transfer about 8 ml. of the standard solution to a second 4-inch test tube and place it in the colorimeter in the same manner as the blank. Read the optical density scale. Rinse this second test tube thoroughly, first with distilled water, then with the sample to be used. Use this same test tube in the same position in the instrument for each of the unknown samples, taking readings in the same manner as with the standard.

Until recently a Duboscq-type visual colorimeter had been used for the colorimetric determinations. The use of this type of instrument was not only time-consuming,

Using Bausch and Lomb Spectronic 20

Pipetting samples to be used for assay

but led to inaccuracies because of human errors in the color comparison of the standard and unknown solutions. When we changed to the use of the electronic instrument, we did not wish to modify the digestion process or sample sizes previously used. Although 425 millimicrons is not the point at which maximum absortion occurs, we used this wave-length because the previously-used sample sizes give optical density readings at this wave-length which can be read most accurately on the scale of this instrument.

Table 1. Relationship Between Optical Density of Known Concentrations of Nitrogen-Containing Solutions and Amount of Nitrogen Found

Optical Density[a]	Nitrogen Present	Nitrogen Found
0.07	0.015 mg.	0.0149 mg.
0.14	0.030 mg.	0.0298 mg.
0.22	0.045 mg.	0.0472 mg.
0.28	0.060 mg.	0.0596 mg.
0.34	0.075 mg.	0.0728 mg.
0.42	0.090 mg.	0.0894 mg.
0.48	0.105 mg.	0.1025 mg.
0.54	0.120 mg.	0.1156 mg.
0.635	0.135 mg.	0.1359 mg.
0.83	0.150 mg.	0.1778 mg.

a - Average reading of three samples.

Table I, prepared from results obtained by testing known concentrations of nitrogen at 420 millimicrons, shows that reasonable accuracy is obtained up to an optical density reading of about 0.65. If the extract produces a higher reading than this, a quantitative dilution of the original extract is made and assayed.

Calculation of Assay

Use the following formula with the readings obtained from the optical density scale of the Spectronic 20 Colorimeter to determine the mg.% of total nitrogen in each sample.

$$C_u = \frac{D_u}{D_s} \times C_s \times \frac{100}{\text{Size of sample expressed in ml.}} = \text{mg.\%}$$ (Total amount of nitrogen per 100 ml. of unknown)

C_u = Concentration of unknown
D_u = Optical density of unknown
D_s = Optical density of standard
C_s = Concentration of standard (0.09 mg. of Nitrogen.)

Application of the preceding formula in the calculation of assays is shown by the following example:

Table 2. Results of Assays of Typical Extracts

Name	Sample Size	Average Reading[b]	Standard Reading	Assay
Cocklebur	0.1 ml.	0.325	0.43	67.5 mg.%
Timothy	0.1 ml.	0.42	0.43	87.1 mg.%
Common Sagebrush	0.3 ml.	0.65	0.43	45.3 mg.%
June Grass	0.1 ml.	0.31	0.43	64.8 mg.%
Helminthosporium	0.4 ml.	0.415	0.43	21.6 mg.%

Table 3. Dilution of Extracts Based on Assay

Name	Assay	Amount Used of Concentrate	Amount Used of Diluting Fluid
Cocklebur	67.5 mg.%	40.0 ml.	95.0 ml.
Timothy	87.1 mg.%	55.0 ml.	251.2 ml.
Common Sagebrush	45.3 mg.%	40.0 ml.	50.6 ml.
June Grass	64.8 mg.%	120.0 ml.	268.8 ml.
Helminthosporium	21.6 mg.%	20.0 ml.	1.6 ml.

Table 4. Results of Reassay of Allergens Diluted to 20 mg.%

Name	Sample Size	Average Reading[b]	Standard Reading	Assay
Cocklebur	0.5 ml.	0.46	0.42	19.60 mg.%
Timothy	0.5 ml.	0.47	0.42	19.98 mg.%
Common Sagebrush	0.5 ml.	0.46	0.42	19.60 mg.%
June Grass	0.5 ml.	0.48	0.42	20.52 mg.%
Helminthosporium	0.5 ml.	0.47	0.42	19.98 mg.%

b - Average reading of three samples.

Red Top pollen extract, using a sample size of 0.3 ml., has an optical density of 0.46 (average reading of three samples). The optical density of the standard is 0.43.

$$C_u = \frac{\frac{0.46}{0.43} \times 0.09 \times 100}{0.3 \text{ ml.}} = \frac{1.07 \times 9}{0.3} = 32.1 \text{ mg.\%}$$

Method of Dilution and Standardization

After determination of the actual assay value of the extract as previously described, the next step is to dilute the concentrate to a standard 20 mg.% solution.

Calculation to determine the amount of diluting fluid needed to dilute the concentrate is by allegation. The following is an example of such an allegation using an allergen with an assay of 48.5 mg.%

Allergen	48.5 mg.%		20.0 parts
Desired Concentration		20.0 mg.%	
Diluting Fluid	00.0 mg.%		28.5 parts

In other words each 20 ml. of an allergen assaying 48.5 mg.% when diluted with 28.5 ml. of diluting fluid will make a preparation containing an allergen with a standardized concentration of 20 mg.%

Again filter the assayed extract by means of a Seitz filter; also filter the diluting fluid needed through the same filter to insure retention of all of the concentrate. Mix extract and the diluting fluid well by swirling the flask. Using aseptic technique, bottle this sterilized mixture into 60 ml. and 30 ml. vials.

These vials are then checked for sterility for both aerobic and anaerobic organisms at 24 hour and 48 hour intervals at the Health Service laboratory.

Since these solutions are already bottled, capped and sterile, it is necessary to use sterile needles and syringes to obtain further samples for assaying without causing contamination of the solutions. Withdraw 0.5 ml. of each sample, using aseptic technique, and reassay in the manner previously described.

Table 2 shows the results of assays of typical extracts; Table 3 shows the dilutions of these extracts; and Table 4 shows the results of reassays of these solutions which have been standardized to 20 mg.%.

Summary

The hospital pharmacist should consider seriously the expansion of facilities and professional services to fit the ever increasing needs of the allergist in the accomplishment of his therapy.

Allergenic powders for the purpose of preparing allergenic extracts may be purchased from a number of reputable sources.[3] Powders purchased from such sources are relatively inexpensive and, if properly prepared, will make excellent extractions.

The use of the Spectronic 20 Colorimeter has substantially reduced the number of assay errors due to human frailties. Various dilutions of the allergens may be prepared conveniently and their concentrations quickly checked if necessary; chances of contamination, if these procedures are carefully done, are practically negligible.

Notes and References

1. This amount is generally 1 gram per 30 ml. of diluting fluid for pollens and 10 mg. per ml. for non-pollens.

2. *Clinical Laboratory Method and Diagnosis.* Fourth Edition, Volume 1, pages 274 - 7; Gradwohl, R.B.H., St. Louis, C. V. Mosby Co., 1948.

3. Some of these sources used by the Health Service Pharmacy are listed below in alphabetical order: (1) C. G. Blatt & Co., Independence, Missouri; (2) Endo Products, Richmond Hill, New York; (3) Greer Drug Co., Lenoir, North Carolina; (4) Sharp & Sharp, Everett, Washington; and (5) Stemen Laboratories, Oklahoma City, Oklahoma.

Industry and Hospital Pharmacist Join Forces for Public Information Programs

► A PROGRAM AIMED at reaching 10,000,000 people to inform them of the true price of health was recently launched in the Delaware Valley Area.

Appearing on WBOC-TV's "*Rx for tomorrow*" series, Dr. Robert Haakenson, manager of community education for Smith Kline & French Laboratories; Russell Waugh, professional service representative for S.K.F.; and Robert Simons, director of pharmacy at Memorial Hospital, Wilmington, Delaware, answered telephone questions from viewers during an audience participation television program in Salisbury, Maryland on April 19.

Station officials estimated a majority of the 61,000 television sets in the viewing area were tuned to the prime-time program. Special telephone lines accommodated more than 100 calls during the half hour program and during the two hours after the program was aired.

John Downing of the WBOC-TV staff who moderated the program, called it "a contribution to public education in an area of great confusion."

"Nearly 5,000,000 lives have been saved in America during the past 30 years as a result of a medical revolution which has increased the life span by 10 years," Dr. Haakenson said. A major role in that record was played by the American pharmaceutical industry, he said.

When a viewer asked, "Are these highly-advertised, cheaper vitamins as good as the more expensive products," Mr. Simons said:

"They may be, but your best guarantee of potency and purity is the integrity of the responsible drug manufacturer. These widely advertised vitamins may certainly achieve the U.S.P. standards that they claim to meet. However, because of limitations in enforcement by the Food and Drug Administration, there is no guarantee that such products—whether vitamins or other drugs—actually do meet standards. Less responsible manufacturers may cut corners in the purchase of raw materials, the hiring of skilled technical personnel, or in their manufacturing and quality control processes."

Mr. Simons also pointed out that prescription costs vary among pharmacies because each retail pharmacist must establish charges on the basis of the expenses he must meet and to earn a fair profit.

He said the average retail pharmacist makes a 5.2 percent profit on an average prescription.

"One of the major chores of the professional service representative" Waugh said, "is to overcome the lag in getting new drug information to physicians. . ."

He also noted that costs of prescription drugs must pay for extensive research programs by manufacturing houses, costs of ingredients, production and packaging, promotion and distribution, manufacturer's taxes and profits, wholesaler's operating costs, taxes and profits and retailer operating costs, taxes and profits.

Mr. Simons said the latest survey by *American Druggist* reports the average prescription today costs $3.14. In 1959 the average American spent about $11 for prescriptions, as compared with about $40 per person for tobacco and $54 per person for alcoholic beverages.

The television program is the second of three planned for this WBOC-TV series. In an earlier telecast, Waugh presented the talk "Prescription for Tomorrow." In a third telecast at 6:25 Wednesday evening, April 26, he spoke on a "Prescription for Mental Health."

Participants in the second part of "Prescription for Tomorrow" series were (left to right) Russell M. Waugh, professional service representative for Smith, Kline and French Laboratories in Delaware, Robert Simons, chief pharmacist at Memorial Hospital of Delaware, and Robert Haakenson, manager of Community Education, Smith Kline and French Laboratories, Philadelphia

Officers of the ASHP installed for the 1961-1962 term. Shown left to right are Executive Secretary Joseph A. Oddis, Treasurer Sister Mary Berenice, S.S.M., President Jack S. Heard, and Vice-President Gerard Wolf

1961 ASHP Annual Meeting Chicago, April 23-28

► HOSPITAL PHARMACISTS attending the 1961 Annual Meeting in Chicago, April 23-28, had the opportunity to hear an outstanding hospital pharmacist and educator, Dr. Svend Aage Schou from Copenhagen, Denmark. Here as the guest of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS, Dr. Schou not only brought to ASHP members the benefit of his own philosophies and experiences in hospital pharmacy, but related European traditions with particular note on the practice of hospital pharmacy in Denmark. In his papers on "Our Professional Ethics," and "The Operation of an Assay and Control Division of a Hospital Pharmacy," Dr. Schou inspired hospital pharmacists of the United States to increase their efforts toward better pharmaceutical practice.

A special recognition was given Dr. Schou for his outstanding contributions to this meeting when the membership, at its final session, voted to make him an Honorary Member of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS. In making the presentation, Dr. Don Francke, a past president of the ASHP, presented the following statement on behalf of the Executive Committee:

"Mr. Chairman, Ladies and Gentlemen: Neither science nor professional practice recognizes international boundaries. At this convention we have had the honor of hearing our distinguished colleague from Copenhagen come to our country and give us two very stimulating talks. His discussion on professional ethics and its ramifications for the personal commitment of hospital pharmacists to really practice their profession has been very inspiring as was his talk on the control methods in a hospital pharmacy.

"We deeply appreciate Dr. Schou's coming from Denmark for this purpose and it blends the hearts of hospital pharmacists throughout the world into a stronger bond.

"Dr. Schou, I would like at this time to invite you to come forward to receive a presentation from the Executive Committee.

"Dr. Svend A. Schou of Copenhagen, Denmark, Director of Pharmacy Service at the University Hospital, University of Copenhagen, Dean of the Royal Danish School of Pharmacy, Editor of the Pharmaceutical Journal of Denmark, Mem-

ber of the Danish Pharmacopeia Commission, author of numerous scientific and professional publications, in recognition of your many outstanding contributions, your work in the interest of hospital pharmacy, your participation in the International Pharmaceutical Federation and particularly, sir, your contributions to this 1961 Annual Meeting of the SOCIETY, *it is my pleasure on behalf of the Executive Committee to nominate you as Honorary Member of the* AMERICAN SOCIETY OF HOSPITAL PHARMACISTS *and to present to you a formal, official certificate of this membership which I am sure we will affirm by a vote in a minute."*

Responding, Dr. Schou expressed gratitude for the invitation and stated that "being an Honorary Member of this really great important SOCIETY makes me feel responsible in the future for my further work for hospital pharmacy. Thank you all very much."

Other highlights of the meeting included outstanding papers by friends of hospital pharmacy including those on "The Economic Aspects of Drug Names," by Chauncey D. Leake of Ohio State University, "Public Interest in the Function and Practice of Pharmacy," by Robert P. Fischelis, former secretary of the American Pharmaceutical Association and "Treatment of Hospital Equipment With Beta Propiolactone Vapor," by Samuel H. Hopper of Indiana University Medical Center. All of these papers are scheduled for publication in a forthcoming issue of THE JOURNAL.

Also, in a talk on "Dynamics of Pharmacy in Hospitals," Mr. Ray Brown, superintendent of the University of Chicago Clinics, pointed to the tremendous changes which are occurring in medical care. Mr. Brown, a past president of both the American Hospital Association and the American College of Hospital Administrators, further indicated that pharmacy practice is among the services affected by these changes. He urged hospital pharmacists to prepare for filling the more specialized role which will come about as the result of the creation of composite medical care programs, as well as new approaches to the distribution of medical care.

"The purpose of hospitals has changed from congregating patients to congregating people and the resources necessary for providing modern medical care," stated Mr. Brown. This has been necessary because of the tremendous expense involved in carrying out diagnostic and medical procedures which must now be done cooperatively rather than on an individual basis. Thus, we look toward providing medical care to everyone in the community at a minimum expense. He further suggested areas in pharmacy practice which

Report on the Audit of Pharmaceutical Service in Hospitals was a highlight of the 1961 Annual Meeting. Shown left to right examining one of the hundreds of graphs and charts which make up the report are Clifton J. Latiolais who served as Assistant Director of the Audit, Don E. Francke, Director and associates Gloria Francke and Norman F. H. Ho

Dr. and Mrs. Svend Aage Schou were welcomed by ASHP members and guests at a reception following the meeting of the House of Delegates on Sunday. Shown left to right are Dr. and Mrs. Don E. Francke, Mrs. Schou, Dr. Schou, ASHP President Clifton J. Latiolais, Mrs. Latiolais, Mrs. Joseph A. Oddis, and ASHP Secretary Oddis

would be affected by these changes, as well as the fact that more advances in drug therapy will require increased control in administration of drugs.

Concluding, Mr. Brown urged hospital pharmacists to better prepare themselves for this new role by making certain that their resources keep pace with progress in the other areas of medical care.

Other papers presented by practicing hospital pharmacists were of high interest. These included "Should the Pharmacist Assume Additional Responsibilities for Medication Preparations?" by William M. Heller; "The Application of Data Processing Equipment to the Hospital Formulary," by Peter P. Lamy, Ivan F. Bourn and Herbert L. Flack; "A Modified Medication and Graphic Sheet for Patients' Charts," by Leo F. Godley; and "Unit-Dose Dispensing; Report of a Study," by Kenneth N. Barker, Warren E. McConnell and Lillian Garrity.

Also at the final session, a panel entitled "Patterns for Professional Progress in Hospital Pharmacy," offered an opportunity for audience participation in reviewing future trends. Mr. Leo Godley served as moderator with panelists including Don E. Francke, Svend Aage Schou, and William E. Johnson.

Reports on Audit

Reports on the Audit of Pharmaceutical Service in Hospitals was a highlight of the SOCIETY's 1961 Annual Meeting. This is the most comprehensive study of hospital pharmacy ever carried out in the United States. Results of the Audit were presented in a series of four papers covering "The Setting Within Which the Pharmacist Functions," which included such topics as the hospital pharmacist as a department head, hospital pharmacy facilities, personnel and manpower needs; "The Professional Services of the Pharmacist," "The Administrative Services of the Pharmacist," and "Recommendations and Goals for Hospital Pharmacy." The papers, which included a voluminous amount of statistical material, were the results of a nation wide survey of pharmacy practice in hospitals which was carried out under a grant from the U. S. Public Health Service to the Division of Hospital Pharmacy of the American Pharmaceutical Association and the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS. The project was conducted at University Hospital in Ann Arbor under the direction of Don E. Francke, Director of Pharmacy Service. Mr. Clifton Latiolais, now at Ohio State University Health Center, served as assistant director on a full-time basis over a three year period.

The study was conducted "to determine current patterns of pharmaceutical practice in hospitals and to suggest methods of improving the quality and expanding the scope of these services in the interest of better patient care." The report, which includes hundreds of graphs and charts, is to be published as part of a book entitled "The Setting Within Which the Pharmacist Functions." The statistics, graphs and charts resulting from the Audit give a picture of hospital pharmacy as practiced in the hospitals in the United States today. It is from these detailed statistics that hospital pharmacists' attention is called to specific deficiences along with recommendations for further study and improvement.

Examples of some of these statistics reported at the Chicago meeting are given here so that members will have some indication of the scope of the study:

- The vast majority of chief pharmacists report directly to the head of the hospital and hospital pharmacists as a group rate high in the degree of freedom they have to operate the department in the manner they believe it should be operated.
- Pharmacy floor space allotments in hospitals with 200 beds and over are extremely low.
- Generally speaking, hospital pharmacies are not equipped adequately to provide a broad range of pharmaceutical services.
- Office and library facilities are completely lacking in a significant number of hospitals.
- Approximately 86 percent of all short-term hospitals over 100 beds employed a pharmacist on a full-time or part-time basis in 1957.
- A total of 5,833 pharmacists were employed in all of the nation's hospitals in 1957.
- More than ten thousand pharmacists will be in hospital practice by 1975 according to manpower studies carried out as part of the Audit. This is almost double the number practicing in this specialty in 1957.
- The ratio of men to women in hospital pharmacy is 2 to 1 with more than half of the women being members of religious orders, usually sister pharmacists in Catholic hospitals.
- More women than men practice on a part-time basis and more women serve as staff pharmacists rather than as chief pharmacists.
- A high percentage of all pharmacists practicing in hospitals are young—falling in the age bracket between 20 and 40 years of age.
- In viewing the scope of pharmaceutical service offered in American hospitals, it is evident that numerous opportunities exist for hospital pharmacists to provide a greater range of service than is now being given. Lack of adequate staff, space and facilities are the principal factors raised by chief pharmacists as obstacles to providing a broader scope of service.
- Hospital pharmacists throughout the nation filled some 164 million prescriptions in 1956, amounting to 321 million dollars worth of drugs. In addition, more than 80 million orders for drugs to be administered to patients were dispensed to clinics and nursing units in hospitals. In dollar value, this is more than 27 percent of all prescription drugs produced in the U. S.
- More than 26 million prescriptions were dispensed to outpatients by hospital pharmacists in 1956. These were dispensed through only approximately one-half of the nation's hospitals and, in general, such service is offered through the larger institutions. Significant is the fact that about 50 percent of the outpatient prescriptions filled by hospital pharmacists are supplied to indigent or partially indigent patients. Approximately 30 percent of the outpatient prescriptions are filled for private pay patients while about 20 percent are furnished to others. It is believed that few hospital pharmacies in the United States provide prescription service for the general public.

•Approximately 41 percent of the hospitals in the United States having a pharmacy department operate a manufacturing or bulk compounding program.

•Current practices regarding control procedures on products compounded in bulk in hospital pharmacies point to one of the most serious shortcomings of those with manufacturing programs.

•Approximately 1 out of 4 chief pharmacists is engaged in teaching activities in addition to other departmental functions.

•Almost 6 out of 10 chief pharmacists have opportunities to work out dosage forms for pharmaceutical preparations not available, while more than 4 in 10 have opportunities to carry out projects to extend and improve certain phases of pharmacy service.

•Only about 1 pharmacy in 3 has written policies bearing on such *administrative* practices as pricing of drugs, purchasing, job specifications, development of the departmental organization chart, and orientation of new employees.

•On the *professional* side, less than 1 in 3 pharmacies has established written policies or procedures pertaining to the safe handling of medication on nursing units, handling of flammable material, investigational drugs, and practices to protect against errors in the dispensing of medications.

•A number of chief pharmacists are responsible for other hospital functions, in addition to pharmacy. Approximately 1 in 5 pharmacists serves also as the hospital purchasing agent while 1 in 20 is responsible for central sterile supply service and for central stores.

•Records on pharmacy activities are not comprehensive enough to provide good management tools for the operation of the department.

•At least 85 percent of chief pharmacists have authority to list acceptable sources of supply for drugs purchased for use in their hospital.

•Less than 5 chief pharmacists out of 10 use bid purchasing all of the time. Of these, about one-third obtain their bids through a central office or agency, a practice which usually is required by a regulation originating outside of the hospital where the drugs are dispensed. Use of the formulary system in hospitals tends to increase the frequency of bid purchasing.

•The 321 million dollars spent by hospitals for pharmaceuticals in 1956 represent 15.5 percent of the hospital's commodity budget.

•The average drug inventory per bed ranges from sixty-three dollars and sixty-six cents in hospitals with 400 to 499 beds to three hundred and eleven dollars and nine cents in hospitals with less than 50 beds. Thus, the average drug inventory per bed decreases as the size of the hospital increases.

Herbert L. Flack, 1961 H. A. K. Whitney Lecture Award winner, receives a plaque from Mrs. Jane L. Rogan, President of the Michigan Society

ASHP past-president Don E. Francke presents an honorary membership, the Society's highest award, to Dr. Svend Aage Schou at the closing ceremonies

Dr. Glenn Sonnedecker, director of the American Institute of the History of Pharmacy presents an award for outstanding writing by hospital pharmacists to Miss Elvera Dressler, St. Francis Hospital, Evanston, Illinois. Dr. Dwight Deardorff of the University of Illinois College of Pharmacy receives honorable mention for assistance in the project

Winston J. Durant (left) congratulates Mr. Louis Jeffrey who received the Society's Membership Award

ASHP President Clifton J. Latiolais thanks H. L. Ferrier of Wyeth Laboratories for a ten thousand dollar grant earmarked for a "long-range continuing education program," within the Society

•The rate of annual turnover of drug stock or inventory in hospitals ranges from 1 to more than 6 times a year. About 50 percent of hospitals have a drug stock turnover rate of 3 or 4 times a year while 33 percent have a turnover rate of 5 or more times a year. Nineteen percent of hospitals have a turnover rate of only 1 or 2 times a year.

The above are but a few examples of the statistics available from the results of the Audit. In a final presentation on "Recommendations and Goals for Hospital Pharmacists," Dr. Francke called on hospital pharmacists to consider four points for goals and suggested that the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS take specific action to set into motion a dynamic program to strengthen and expand the scientific and professional aspects of the practice in this specialty. Following presentation of 45 recommendations resulting directly from the findings reported in the study, Dr. Francke further asked hospital pharmacists to break from past traditions and take advantage of the special opportunities which their practice offers. He asked that hospital pharmacists focus their attention on four broad goals during the next several decades, suggesting that coordinated plans be drawn and implemented to:

"1. Strengthen and expand (1) the scientific and professional aspects of the practice of hospital pharmacy, (2) the teaching role of the hospital pharmacist, and (3) his activities in the field of investigation and research.

"2. Strengthen and perfect the administrative or management skills and tools essential to the hospital pharmacist in his role as a department head.

"3. Attract a greater number of well trained pharmacists to hospital practice, including those with specialized education and training in hospital pharmacy.

"4. Promote payment of realistic salaries to hospital pharmacists in both staff and managerial positions in order to attract and retain the services of career personnel."

The AMERICAN SOCIETY OF HOSPITAL PHARMACISTS was asked to take specific action in order that the goals may be transformed into reality. It was from this recommendation that President Heard appointed a Commission on Goals.

Honors, Awards, and Special Events

Opening the ASHP activities on Sunday following the meeting of the House of Delegates, members welcomed Dr. and Mrs. Schou at a reception headed by President and Mrs. Clifton J. Latiolais. Here, members of the SOCIETY and invited guests met Dr. and Mrs. Schou. Also, this event offered an opportunity for all hospital pharmacists in attendance to meet together for an informal reception.

Hospital pharmacy's highest honor, the H. A. K. Whitney Lecture Award was presented to Mr. Herbert L. Flack at a dinner honoring the recipient on Tuesday night. With Mr. Grover C. Bowles serving as toastmaster, greetings and tributes were presented by Don Francke for the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS, Dr. Joseph Anderson for the American Hospital Association, Dean Linwood F. Tice of the Philadelphia College of Pharmacy and Science and close associate of Mr. Flack's; Mr. Ronald Robertson for the American Pharmaceutical Association; and Mr. John P. James for the Catholic Hospital Association. On presenting the plaque commemorating the occasion, Mrs. Jane Rogan, president of the Michigan Society, paid tribute to Mr. Flack's "perserverance and performance in duties in hospital pharmacy, most of the time above and beyond the call of duty." Responding, Mr. Flack presented the 1961 H. A. K. Whitney Lecture Award entitled "Goals for Hospital Pharmacists," in which he outlined, with his usual enthusiasm, the work ahead for hospital pharmacists and the AMERICAN SOCIETY OF HOSPITAL PHARMACIST.

Two Illinois hospital pharmacists, Mrs. Elvera H. Dressler, pharmacist at St. Francis Hospital in Evanston and Professor Dwight L. Deardorff of the University of Illinois College of Pharmacy, Chicago, received an award "in recognition of the best contribution toward recording and interpreting the development of hospital pharmacy." This award is presented annually by the American Institute of the History of Pharmacy in cooperation with the Committee on Historical Records of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS. Presentation was made by Dr. Glenn Sonnedecker, director of the Institute, indicating that the manuscript on a history of the Illinois Society of Hospital Pharmacists had been selected as particularly meritorious in the 1961 competition. It was pointed out that this year's prize essay was especially notable because one of the authors, Mrs. Dressler, played an important part in the actual founding of the Illinois Society and was its first president (1941-42, 1942-43), while the co-author, Professor Deardorff, presently serves as historian of the organization, and has also been honored as its president (1955-56).

Mr. Louis P. Jeffrey, chief pharmacist at Albany Medical Center, Albany, New York was the recipient of the SOCIETY's second annual membership award. Mr. Jeffrey was given special recognition for his contributions in recruiting members for the American Pharmaceutical Association and the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS over a period of years. He has served as Chairman of the Committee on Membership and Organization and is currently on the SOCIETY's Executive Committee.

To provide for initiating a "long-range continuing education program," by the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS, Wyeth Laboratories of Philadelphia presented a ten thousand dollar grant to the SOCIETY. Presentation of the check was made to ASHP President Clifton J. Latiolais by H. L. Ferrier, manager, hospital promotion, for Wyeth Laboratories. On

accepting the grant, President Latiolais stated that "this will aid in fulfilling a need existing among hospital pharmacists for programs which will make it possible for them to keep up-to-date. Constant changes in practice, as well as the demands relating to the many new drugs being made available are ever increasing."

According to President Latiolais and Secretary Oddis, specific use of the funds will be directed towards setting up a unit which will supplement present services now available through the SOCIETY, including annual institutes, seminars, and assistance with internship programs. Tentative plans in the SOCIETY call for a program to strengthen and expand the present formal internship programs for new graduates, placing greater emphasis on professional and scientific training; establishment of a nation wide network of specialized training programs in selected hospitals; encouraging hospital pharmacists to expand their teaching role in the hospital; and encouraging students to enter the specialty of hospital pharmacy.

Business Sessions and House of Delegates

Members of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS and representatives from forty-three of its fifty-five Affiliated Chapters gave attention to numerous important matters with which the SOCIETY is confronted at this time. Reports received from the officers and committees were indicative of the increasing problems facing not only hospital pharmacists but the total profession. The Executive Committee met on several occasions throughout the Convention and a report of its actions was presented to the membership by Secretary Joseph Oddis.

Of particular note were the reports of the President and of the Executive Secretary in which attention was given to numerous changes which are being made in the office of the secretary in order to consolidate SOCIETY activities. The Executive Committee asked for a change in the SOCIETY's By-Laws in order to bring together SOCIETY financial activities and also reported in detail with regard to future plans for the *American Hospital Formulary Service*. As will be noted from the Secretary's complete report, the Office of the Secretary of the *American Hospital Formulary Service* will be moved to Washington, D. C. during the summer. Secretary Oddis also reported on the new office setup in Washington as the result of the addition of the new A.Ph.A. headquarters and indicated changes in personnel in the office of the Division of Hospital Pharmacy.

Among the highlights of some of the other officer and committee reports were the following:

- Reported a net increase in membership of 258 (this is for a eight month period, that is since the last Annual Meeting in August, 1960).
- Recommended that each Affiliated Chapter appoint a designated representative to follow developments concerning laws, legislation and regulations which pertain to hospital pharmacy practice.
- Recommended that work be renewed on the preparation of an incompatibility chart for medications administered in the same syringe. Further, that a coordinated research program be instituted to study methods of detection of medication errors in hospitals.
- Accepted a grant from Wyeth Laboratories for a continuing education program.

Also under business at the House of Delegates' meeting on Sunday, Dr. William Heller, director of the *American Hospital Formulary Service*, reported on the status of the *Service*. Details of this report are of interest to all subscribers and members of the SOCIETY. Since this constitutes a special report to the membership, it is printed in full in this issue of THE JOURNAL (see page 366).

Actions taken at the Annual Meeting in the form of resolutions can be summarized as follows. The complete text of all resolutions will appear in the Proceedings Issue of THE JOURNAL which will be published during the next few months.

- Approved a change in the By-Laws calling for the consolidation of SOCIETY financial activities into one general ledger which will detail SOCIETY, JOURNAL, *Formulary Service*, and other major activities individually. A further minor amendment to the By-Laws calls for a deletion "from membership dues," from Chapter II of the By-Laws. This is concerned with the receipt of funds by the treasurer.
- Asked that the SOCIETY request the Committee on Revision of the United States Pharmacopeia to consider providing standards for plastic materials used for medical and pharmaceutical purposes.
- Referred to the Committee on Safety Practices and Procedures for further study a recommendation asking that all references to the title "Normal Saline Solution" be omitted from all labeling since the official compendia no longer recognizes this title.
- Referred to the Committee on Safety Practices and Procedures for further study a recommendation asking that the manufacturers of electrolyte preparations be requested to express the potency both in terms of milliequivalents and in the metric system, with emphasis on the milliequivalent.
- Asked that pharmaceutical manufacturers be encouraged to facilitate the filing of literature on their drugs by including thereon the *American Hospital Formulary Service* category numbers.
- Resolved that the SOCIETY request the cooperation of the National Association of Boards of Pharmacy to petition the respective boards of pharmacy in those states to consider granting total credit for experience in hospital pharmacy toward licensure requirements.
- Asked that each of the Affiliated Chapters be advised to appoint a member to review proposed laws, legislation and regulations in detail and report his findings to the Affiliated Chapter and to the Chairman of the Committee on Laws, Regulations and Legislation of the SOCIETY.
- Asked that the SOCIETY express its gratitude and appreciation to the Food and Drug Administration with regard to its effective and intelligent leadership in establishing new regulations for clear concise labeling of literature.
- Asked that acknowledgement and appreciation of the assistance from the United States Public Health Service to the Audit of Pharmaceutical Service in Hospitals be expressed.
- Expressed sympathy on the death of Hans S. Hansen, a past president of the SOCIETY.
- Acknowledged the outstanding contribution of the Fourth Supplement to the *Comprehensive Bibliography on Hospital Pharmacy* as published in THE JOURNAL.

- Expressed sincere appreciation to Wyeth Laboratories for its grant for a continuing education program.
- Expressed confidence in the leadership of Secretary Joseph A. Oddis and pledged continuing support.
- Expressed thanks and appreciation to all thoughtful individuals, committees, and organizations who extended to the Society's members and guests, the excellent program arrangements, the many fine services, accommodations and entertainment features of the 18th Annual Meeting held in Chicago, Illinois.

New Officers and Nominees

At the final general session on Thursday, President Latiolais installed the new officers to serve during the 1961-1962 term. Mr. Jack S. Heard, St. Francis Hospital, San Francisco, was installed as President. Serving with him as Vice-President is Mr. Gerard Wolf of Mercy Hospital, Pittsburgh, Pa. The Executive Secretary, Mr. Joseph Oddis, of Washington, D.C., continues to serve a three year term, and Sister Mary Berenice, S.S.M., continues to serve during a three year term as Treasurer. Other members of the new Executive Committee for the 1961-1962 term were listed in the May issue of This Journal. In the inaugural address of the President-Elect, Mr. Jack Heard named new committee chairmen and outlined activities for the new year.

Nominations for officers of the American Society of Hospital Pharmacists for the 1962-1963 term are as follows:

For President: Louis P. Jeffrey, Albany, New York and Milton W. Skolaut, Bethesda, Maryland.

For Vice-President: Richard G. Henry, Madison, Wisconsin, and John Webb, Boston, Massachusetts.

For Treasurer: Sister Mary Berenice, S.S.M., St. Louis, Mo., and Sister Mary Florentine, Columbus, Ohio.

The president and vice-president are elected for one year terms and the treasurer is elected for a three year term. Ballots for the election will be sent to all active members of the Society within sixty days following the nomination.

Committees

No small part of the success of the 1961 Annual Meeting was due to the efforts of the local committee headed by Mr. Edgar Duncan. Arrangements for special events, assistance to the officers and committees of the Society, and the ever-presence of the members of the local group contributed much in making not only the program but the total Annual Meeting a memorable occasion. The local committee was made up of members from both the Illinois Society of Hospital Pharmacists and the Midwest Association of Sister Pharmacists including William R. Collins, Kate Mathews Whitfield, Mary A. Petersen, Daniel A. Ravegnani, James S. Palmgren, Sister Marie G. Fox, and Sister Mary Kateri.

Also, throughout the week, representatives of the local committee were in the Society's suite to welcome hospital pharmacists and provide coffee through the courtesy of Pfizer Laboratories. Sister pharmacists attending the Convention had available a suite for informal gatherings throughout the week. Here, refreshments were served through the courtesy of the American Hospital Supply Corporation.

A reception prior to the Whitney Award Dinner on Tuesday night was sponsored by McKesson and Robbins.

A final note in the special events was the traditional breakfast held on Thursday morning prior to the final session of the Annual Meeting. With President-Elect Jack S. Heard presiding, this was a completely informal meeting with no special program. The breakfast was sponsored by E. R. Squibb and Sons.

The program for the Annual Meeting was in charge of the Society's Committee on Program and Public Relations headed by Mr. Paul Parker, University of Kentucky Medical Center, Lexington, Ky.

Business sessions were presided over by President Clifton Latiolais.

"Defend the Profession"

► "WANTED—Pharmacists who will Defend the Profession" is the battle cry of the fund raising campaign which has been launched by the American Pharmaceutical Association to defend the principles involved in the Justice Department's attacks on pharmacy. Every member of the Association is receiving detailed information regarding the campaign as well as developments in the pending antitrust cases in Arizona, California, Idaho and Utah.

At the Annual Convention in Chicago, the following resolution was passed and all pharmacists are being asked to contribute to "Defend the Profession."

Whereas, certain antitrust cases are now pending which are vital to the entire profession, therefore

Be it Resolved, that the House of Delegates endorse the action of the Council that the American Pharmaceutical Association undertake at once a national fund-raising drive among individual pharmacists to defend the professional principles involved in these test cases.

Contributions may be sent to:

Defend the Profession
P. O. Box 1921
Washington 13, D. C.

Therapeutic Trends

edited by WILLIAM JOHNSON, *Bronson Methodist Hospital, Kalamazoo, Michigan*

Actinospectacin—A New Antibiotic

An antimicrobial agent, actinospectacin, has been isolated from broth cultures of an actinomycete, Streptomyces spectabilis, UC 2472. The antimicrobial properties of this antibiotic are described by Lewis and Clapp as reported in *Antibiotics & Chemotherapy 11*:127 (Feb.) 1961, and supporting data are presented in tabular form. It is active *in vitro* and *in vivo* against a variety of both gram-positive and gram-negative organisms although it elicits a greater response *in vivo* than might be expected from its *in vitro* activities. The *in vivo* studies were made using mice as the test animals. Actinospectacin is more effective when administered by the parenteral route than by the oral route. The trade name of the Upjohn Company for actinospectacin is Trobicin.

WILLIAM E. JOHNSON

Nitrogen Mustard Therapy Combined With Autologous Marrow Infusion

In Kenya, malignant diseases of the head and neck present a problem. Many cases are not suitable for surgery and the only treatment is chemotherapy. Clifford *et al.* conducted a trial study using large doses of nitrogen mustard. These large doses may be safely used if combined with autologous marrow infusions. The recommended pharmacopoeial dose of nitrogen mustard of 0.1 mg./Kg. body weight daily for five days failed to produce an adequate response of relief of pain, in the type of case treated. Thirty-three patients who suffered with advanced or generalized growths received up to a total of 2 mg. per Kg. body weight of nitrogen mustard. This dose was given in palliative treatment. Three patients who received 2 mg. per Kg. body weight were also given autologous marrow infusions. All recovered, and 3 who did not receive the marrow infusions died from the toxic effects of similar doses of nitrogen mustard on the reticuloendothelial system. The tests showed that patients may survive large dose nitrogen mustard therapy if this is supplemented with autologous marrow infusion. The study was reported in *Lancet 1*:687 (Apr. 1) 1961.

RICHARD H. HARRISON

Nonsteroidal Estrogen Antagonist

Ethamoxytrithetol, a nonsteroidal compound 1-(*p*-2-diethylamino-ethoxyphenyl)-1-phenyl-2-p-anisylethanol, antagonizes the activity of both endogenous and exogenous estrogens. In previous animal studies it was demonstrated to be an antagonist of both steroidal and nonsteroidal estrogens. Twenty-five patients with chronic cystic mastitis were given varying amounts of ethamoxytrithetol, MRD-531 (enteric-coated sustained release tablet), and MRD-531-A (uncoated sustained release tablet). The usual starting dose of ethamoxytrithetol used in the present study was 250 mg. orally, once or twice daily for one week, and then a gradual increase each week until a total daily dose of 1.0 to 2.0 Gm. was being taken. The subjective improvement noted by 22 of the 25 treated patients was impressive but the results noted by physical examination of the breast were even more striking after several months of continuous treatment. Firm, nodular areas of thickening which were exquisitely tender became softer and more confluent. R. Kistner, reporting in the *Am. J. Obstet. Gynecol. 81*:233 (Feb.) 1961 found that side effects were minimal with the sustained release preparation. Ethamoxytrithetol was supplied as MER-25 by Wm. Merrell Co.

SYLVIA SCHMIDT

Compound 10611—An Antitussive Agent

In 24 subjects without acute respiratory complaints, cough was induced by means of inhalation of nebulized citric acid solution. The tests were repeated in the same subjects one hour after the administration of 30 mg. of codeine, 25 mg., 50 mg., and 100 mg. of preparation 10611, a non-narcotic agent. In comparison with the antitussive effect of 30 mg. of codeine, preparation 10611 was found to be considerably more effective. Groszman *et al.* state in *Applied Therapeutics 3*:95 (Feb.) 1961 that all patients tolerated this drug without any side effect. Complete blood counts and urine examinations done before and at the end of the tests did not reveal any change. Chest x-rays taken before and after the trial showed no change. 10611 was supplied through the courtesy of Ciba Company as Melipan.

SYLVIA SCHMIDT

Effect Of Polycarbophil On Diarrhea And Constipation

Polycarbophil, a synthetic macromolecular substance, exhibits relatively marked capacities for absorption and retention of water *in vitro*. A comparative evaluation of the influence of Polycarbophil and psyllium hydrophilic mucilloid on stool water content and normal

bowel habits was first carried out in 10 healthy adult volunteers. The therapeutic efficacy of Polycarbophil was compared with that of psyllium mucilloid and a kaolin-pectin suspension in 24 patients with severe chronic diarrhea. Sixty-nine percent obtained significant symptomatic benefit from Polycarbophil, 67 percent from psyllium mucilloid, and none from the kaolin-pectin mixture. The frequent administration of small doses of Polycarbophil (0.5 to 1.0 Gm. every 2-4 hours) increased its effectiveness in control of diarrhea. The drug was then compared with that of psyllium mucilloid in 26 patients with chronic constipation. Polycarbophil effectively relieved chronic constipation in 80 percent of patients, psyllium mucilloid in 67 percent. Prolonged administration of Polycarbophil had no deleterious effect on the nutrition of patients. Pimparker *et al.* reporting in *Gastroenterology 40*:397 (Mar.) 1961 believe that this preparation is a useful and safe agent for the symptomatic management of both chronic diarrhea and chronic constipation. Polycarbophil is manufactured by White Labs. Inc.

SYLVIA SCHMIDT

Diethylpropion In Treatment Of Obesity

A double-blind trial of diethylpropion was carried out on 40 obese patients who had proved refractory to dietetic advice alone. The difference between their mean gain in weight when given dummy tablets and their mean loss of weight when taking diethylpropion was statistically highly significant at all times. No important side effects occurred, according to Seaton, *et al.*, reporting in the *Brit. Med. J.* page 1009 (Apr. 8) 1961. Apart from its expense, the authors suggest that this drug seemed to be suitable for use as a short-term adjunct to the dietary treatment of obesity.

KENNETH W. HUCKENDUBLER

Streptonigricin - Clinical Observations

A filtrate obtained from *Streptomyces flocculus* was found to inhibit the growth of several transplantable mouse tumors. A purified preparation of the major active component was prepared which, because of its dark brown color, was named streptonigricin. The structure of streptonigricin has not been determined. In laboratory animals streptonigricin causes severe local injury at the injection site and it is a substance of extraordinary toxicity in man, having a tolerated dose in the range of 1.75 to 2.25 mg. (30 to 45 gammas/Kg.) per course of treatment. Toxicity is delayed and consists principally of severe and prolonged bone marrow depression with leukopenia and thrombocytopenia, and variable degrees of diarrhea with anorexia and weight loss.

Hackethal *et al.* report the use of this antibiotic, in *Antibiotics & Chemotherapy 11*:178 (Mar.) 1961, in 31 patients with various forms of advanced, nonresectable neoplastic disease. Therapeutic effects in the form of decrease in fever, pruritus, and size of enlarged nodes were observed only in Hodgkin's disease, and then at dosages that caused severe bone marrow depression. On the basis of the therapeutic trials reported on 31 patients with various forms of neoplastic disease, streptonigricin did not appear to have a practical role in the management of several major types of cancer. The streptonigricin used in this study was supplied by Chas. Pfizer & Company, Inc.

WILLIAM E. JOHNSON

Kayexalate Used To Treat Hyperkalemia Of Renal Failure

Sodium polystyrene sulfonate is a cation exchange resin in the sodium phase. The sodium ions are attached to side chains of the resin structure and available for exchange. The higher the atomic weight of a cation, the greater the affinity of the resin. Thus, in an environment with potassium ions, sodium will be replaced by potassium. The resin is a finely ground, light brown powder and is administered in a suspension with water, ginger ale, or sorbitol. The average oral dose is 15 Gm., two to six times daily. To counteract constipation, and to provide for the eventual removal of the resin bound potassium, a mild laxative is used. Nausea and vomiting can be reduced by administration of one of the phenothiazine derivatives or may be overcome by administration of the resin suspension through a gastric tube. If vomiting cannot be controlled, the resin may be given by rectal administration, using proper technique. Rectal administration requires a higher dose, from 30 to 60 Gm. from 2 to 6 times a day.

In *J. Am. Med. Assoc. 175*:689 (Feb. 25) 1961, Steinmetz and Kiley report the use of this treatment in 25 cases of hyperkalemia of renal failure. The results indicate that hyperkalemia of renal failure can be controlled in the majority of patients by proper oral or rectal administration of sodium polystyrene sulfonate in conjunction with restriction of potassium intake. The effectiveness of resin therapy depends on the availability of the gastrointestinal tract as a locus of exchange. The main untoward effect of the resin is hypokalemia and daily potassium determinations are done. In a digitalized patient, hypokalemia may cause digitalis toxicity. No significant changes of cations other than potassium were observed in this series.

WILLIAM E. JOHNSON

The above article on Kayexalate appeared in the April (1961) issue of This Journal. However, it is repeated here due to the fact that several lines were inadvertently omitted.

Consulting WITH BOWLES

GROVER C. BOWLES JR., *Baptist Memorial Hospital, Memphis, Tennessee*

► Are hospitals concerned with alcohol tax drawback?

Only if they purchase tax-paid alcohol. Federal regulations provide for a drawback of $9.50 on which $10.00 tax has been paid. The hospital using tax-paid alcohol must submit Form 1678 in order to obtain the tax-paid drawback.

► Is it permissible to use tax-free alcohol in the preparation of flavoring extracts for the dietary department?

No. Tax-free alcohol must not be used in food, beverages or flavoring extracts.

► What is industrial alcohol?

Industrial alcohol is ethyl alcohol produced and sold for other than beverage purposes. Thus, Alcohol, U.S.P. and denatured alcohol may be termed industrial alcohols.

► What methods do pharmacists use to keep current on therapeutic uses and other information about new drugs?

There is no easy way. Read not only the manufacturer's literature but our own JOURNAL, the A.Ph.A. Journals and other pharmaceutical publications. *The Journal of the American Medical Association,* the *New England Journal of Medicine* and other current journals found in the hospital library should be scanned regularly in an effort to keep up to date. Having and using up to date text books in pharmacology, pharmacy, chemistry, toxicology and microbiology will provide the background necessary to interpret current therapeutic trends in an intelligent manner.

► What is done about the charges for home going medications which are not covered by hospitalization insurance?

Medications furnished during the hospital stay or at discharge which are not included in the patient's insurance coverage are billed to the patient in the same manner as other services not included in the insurance coverage.

► Please send us a list of commercial laboratories that do tests for pyrogens and other assays required for a good quality control program.

Commercial laboratories offering this type of service are located in most large cities. You might consult the classified advertisements in your local telephone directory for some leads. If your hospital is not located in a metropolitan center, my suggestion is that you obtain the services of a commercial testing laboratory in the nearest large city. If good service at reasonable prices is not conveniently available, why not arrange to have pyrogen testing and other assays done in the hospital laboratory?

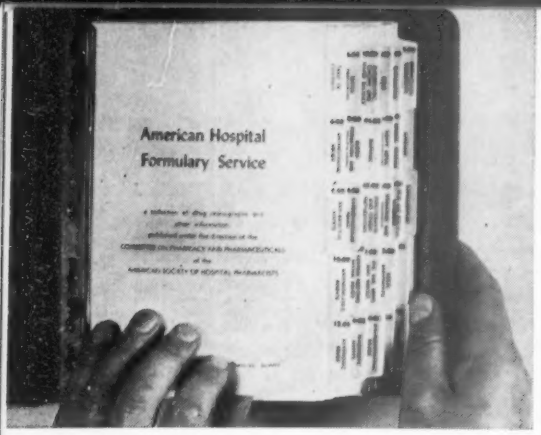
► Should appointments to the Pharmacy and Therapeutics Committee be by the name of the person or by the title of the position he holds on the hospital staff?

Usually a person is appointed to the Pharmacy and Therapeutics Committee because of his particular knowledge, interest and experience. For this reason, appointments should be made by name from among the senior members of the medical staff. So far as possible, all services should be represented. Appointments should be for a specific term and staggered so that at no time does the committee consist entirely of new members.

► Why couldn't or shouldn't the ASHP adopt a method such as the A.M.A. uses in the placement of interns?

First, the National Intern Matching Program is the official cooperative plan developed by the agencies concerned with the appointment of medical interns, not the A.M.A. alone. It is a moderately complex system which attempts to bring order out of the chaos which results because available medical internships now number almost twice the applicants for these positions. Competition is keen among the medical graduates for internship appointments in the major teaching hospitals of the country. This system of matching is advantageous to the medical students since, (1) it protects him from the pressure while exercising the right of his selection, (2) assurance that no position will be filled prior to his application, and (3) an internship appointment to the hospital highest on the intern's list which will accept him.

As I see it, we do not have a comparable situation in hospital pharmacy. For the most part, the pharmacy graduate wishing to intern in hospital pharmacy can obtain an internship at the hospital of his choice without great difficulty. In recent years the number of internships available have exceeded the number of people desiring hospital pharmacy internships. For this reason, there does not appear to be a need for an internship matching program for hospital pharmacy until the demand for internship training increases significantly.



AMERICAN HOSPITAL FORMULARY SERVICE

edited by WILLIAM HELLER, *Chairman ASHP Committee on Pharmacy and Pharmaceuticals*

Status of the American Hospital Formulary Service, 1961

A Report from the Committee on Pharmacy and Pharmaceuticals

WILLIAM M. HELLER, *Director*

► IN VIEW OF THE CONTINUING increase in acceptance of the *American Hospital Formulary Service* and its importance to hospitals and to the SOCIETY, the *Formulary Service* remains the chief interest of the Committee on Pharmacy and Pharmaceuticals.

Total Sales

Total sales of the *Formulary Service* at the end of the 1960 calendar year were 10,137. New subscriptions during 1960 totaled 2,976. Invoices for the 1961 supplement service were recently sent to all subscribers but it is too early to report on the number of subscriptions renewed for 1961.

Supplements

As anticipated, six supplements to the *Formulary Service* were issued during 1960. Six supplements, with increasing numbers of 32-sheet supplements, are again planned for 1961. As you know from the First 1961 Supplement, the supplements will be renumbered and will include a complete new index each year.

Binders

The Committee at a January meeting in Lexington, Kentucky, took the following actions with regard to binders for the *Formulary Service*:

1. A post binder large enough in capacity to contain all material published to date and to allow for future needs will be adopted.
2. A split-ring type binder, which will be used in duplicate to divide the *Formulary Service* into two volumes, will be adopted.
3. Subscribers will have their choice of the two binders.

The present supply of binders probably will not last for the remainder of the year. As soon as the new binders are available, subscribers will be notified.

Presented at the 1961 Annual Meeting of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS, Chicago, April 23-28.

Price of the Formulary Service

Further reductions in volume prices of the *Formulary Service* are now in effect. The new price structure for initial subscriptions follows:

1 to 9 copies	$15.00 per copy
10 to 24 copies	$14.50 per copy
15 to 49 copies	$14.00 per copy
50 to 99 copies	$13.50 per copy
100 or more copies	$13.00 per copy

The price of the supplement service remains the same, with no reductions below $4.50 yearly per subscription for 25 or more subscriptions. The price of the *Formulary Service* without binder has been reduced from $13.00 to $12.00 per copy, or $3.00 less per book without binder on all orders. The above prices are effective as long as the present supply of books and binders remains. When a new binder is adopted and when the Service is reprinted, prices will again be reviewed based on new costs.

ASHP COMMITTEE on Pharmacy and Pharmaceuticals

Members of the Committee previously have served indefinite terms. The Chairman and the Secretary of the Committee, Dr. Heller and Mr. Provost, have been made ex-officio members and the remaining four members will serve staggered four-year terms, one new member to be appointed by the President of the SOCIETY, with the approval of the Executive Committee, each year. Besides the Chairman and the Secretary, the Committee is now composed of Messrs. Grover C. Bowles, Don E. Francke, Leo F. Godley, and Clifton J. Latiolais.

Formulary Service Reference Committee

Members of the Reference Committee are: Dr. George F. Archambault, Dr. Lincoln Chin, Miss Margene O. Faddis, Mr. Edward A. Hartshorn, Dr. Mar-

cus W. Jordin, Mr. Jack C. Kirkland, Dr. Kermit E. Krantz, Dr. Mildred Montag, Dr. Albert L. Picchioni, Dr. Joy B. Plein, Dr. G. Victor Rossi, Mr. Edward Superstine, Mr. Vernon O. Trygstad, and Dr. Charles O. Wilson.

This is identical to the 1960 Committee except for the absence of Dr. Warren McConnell, who was forced to discontinue membership because of the pressure of other duties. Dr. Joy Plein continues to serve as Assistant to the Chairman. Dr. Marcus Jordin is still serving on the Reference Committee although he is not able to serve as Assistant to the Chairman this year.

Promotion of the Formulary Service

Plans are being made for advertising the *Formulary Service* on a small scale in a limited number of professional journals. At the present time, these will probably be primarily nursing journals, as a great need and interest is apparent among nursing educators and practitioners.

Office of the American Hospital Formulary Service

The professional operation of the *Formulary Service* is now based at the University of Arkansas Medical Center in Little Rock. Printing and distribution remain in the hands of the Hamilton Press, Inc., Hamilton, Illinois. The availability of additional space for the SOCIETY in the American Institute of Pharmacy in Washington, D. C., and the desirability of centralizing SOCIETY activities have led to a decision to relocate the *Formulary Service* in Washington at the end of the current fiscal year. The Secretary of the Service, Mr. Provost, will be moved to Washington in addition to some administrative functions now handled by the Hamilton Press. In achieving the transfer, no change in the organizational plan results. Dr. Heller will continue to serve as Director of the Service and Chairman of the Committee on Pharmacy and Pharmaceuticals and will remain in Little Rock. Relocation of the *Formulary Service* will result in administrative coordination and effective utilization of clerical and secretarial personnel and facilities.

Bulk Compounding Compendium

The Committee has been given the task of preparing a bulk compounding compendium for use by practicing hospital pharmacists. Such a compendium in book form is not imminent. Initially, we plan to publish our material in the AMERICAN JOURNAL OF HOSPITAL PHARMACY as reports of the Committee on Pharmacy and Pharmaceuticals. Eventually, sufficient such reports may accrue to make it worthwhile to publish them in book form.

We welcome specific suggestions from our members as to the products for which properly researched formulations are most needed. We also would be pleased to know of pharmacies with personnel and facilities adequate for compounding batches and who could have clinical studies carried out by qualified members of their medical staff. In this respect, it is likely that the pharmacists and physicians of any one hospital would be more concerned with one clinical specialty than another. In one hospital, possibly only the dermatologists would be interested in working with you; in another, possibly only the ophthalmologists. Such information would help us when we are looking for clinical situations into which to farm out formulations which appear promising after laboratory research.

Professional Prerogatives

WHEREAS, it is recognized that the public protection with respect to quality of dispensed medication rests in the final analysis on the free exercise of the professional judgment of the pharmacist; therefore

BE IT RESOLVED, that the following statements reflect the current official policy of the American Pharmaceutical Association:

1. Only the prescriber has the legal right and professional responsibility to determine the medication required in patient treatment.

2. It is recognized that the use of the nonproprietary name, including U.S.P. and N.F. titles, is a legal and a scientific nomenclature system for drugs; and it is recognized that the use of the proprietary name is a legal nomenclature system.

3. The pharmacist is charged by ethics and law to exercise his personal professional judgment and responsibility in dispensing each prescription.

4. It is essential in the interest of public health and patient care that there be no interference with these professional prerogatives of prescribing or dispensing.

—Resolution adopted at the 1961 Annual Meeting of the American Pharmaceutical Association, Chicago, April, 1961.

News

ASHP Past Presidents Among A.Ph.A. Nominees

GEORGE F. ARCHAMBAULT of Washington, D. C. and GROVER C. BOWLES of Memphis, Tennessee, both past-presidents of the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS, have been nominated for posts in the American Pharmaceutical Association. Dr. Archambault, who heads the Pharmacy Service in the U. S. Public Health Service and serves as Liaison Officer to the Surgeon General, is one of two candidates for president of the A.Ph.A. for the 1962-1963 term. Dr. Archambault served as ASHP president for the 1954-1955 term and has been active in numerous capacities in the A.Ph.A. and the SOCIETY. For the past several years, he has served as chairman of the A.Ph.A. Council.

Grover C. Bowles of Baptist Hospital in Memphis has been nominated for membership on the Council of the A.Ph.A. for a three year term. Also a past president of the SOCIETY, Mr. Bowles has served on the A.Ph.A. Council and at the recent Convention in Chicago, was elected for a second term as chairman of the A.Ph.A. House of Delegates.

Other nominees for officers and councilors are:

For president: (in addition to Archambault named above); Robert J. Gillespie, St. Joseph, Mich.

For first vice-president: Calvin Berger, New York, N. Y. and J. Curtis Nottingham, Williamsburg, Va.

For second vice-president: Lee E. Eiler, Dayton, Ohio, and Harmon C. McAllister, Chapel Hill, N. C.

For councilor: (in addition to Bowles named above); Robert A. Hardt, Chicago, Ill.; Frederick D. Lascoff, New York, N. Y.; Henry M. Moen, St. Paul, Minn.; George L. Scharringhausen, Jr., Park Ridge, Ill.; and Ralph M. Ware, Jr., Richmond, Va.

Ballots for election of officers and council members will be send to all members of the American Pharmaceutical Association within sixty days after the close of the Convention.

Hospital pharmacists are urged to vote in the election.

► EUGENE C. DOONER JR., has been appointed hospital field manager for McNeil Laboratories, Inc., Philadelphia. Mr. Dooner joined the sales staff of the pharmaceutical manufacturing company in 1949 as a professional service representative, covering the Washington, D. C., area. In 1958 he was appointed special government representative for the firm in its service to government hospitals and facilities.

New Jersey Society Sponsors Institute

The New Jersey Society of Hospital Pharmacists, in cooperation with the New Jersey Hospital Association, sponsored an Institute at the Roger Smith Hotel in New Brunswick, New Jersey, on May 4. The morning session was presided over by Miss Geraldine Stockert, chief pharmacist at the Monmouth Medical Center in Long Branch, New Jersey. The following papers were presented:

"Trends in Operation of the Hospital Pharmacy," by Don E. Francke, University of Michigan Medical Center, Ann Arbor, Michigan.

"Laws Affecting the Operation of a Hospital Pharmacy," by George F. Archambault, chief of pharmacy service, Hospital Division of U. S. Public Health Service, Washington, D. C.

"Today Generic Equivalents Are Everybody's Business," by William Woods, representative of pharmaceutical manufacturers and executive assistant of the National Pharmaceutical Council, New York City.

The afternoon session was devoted to a discussion of hospital formulary systems with Martin S. Ulan, administrator of Hackensack Hospital, Hackensack, N.J., serving as moderator. Mr. Herbert Flack, assistant administrator of Jefferson Medical College Hospital in Philadelphia, spoke on "Hospital Formulary Systems." This was followed by a panel under the title "Hospital Pharmacy Operations and Formulary System," with the following participants: LaVerne Morck, R.N., assistant director of nursing service in charge of surgical nursing, Hackensack Hospital, Hackensack, N. J.; George F. Stoll, chairman, Drug and Formulary Committee, Clara Maass Hospital, Belleville, N. J.; Robert Boyd, administrator, Morristown Memorial Hospital, Morristown, N. J. and chairman, Council on Professional Practices of the New Jersey Hospital Association; Herbert Flack representing hospital pharmacists; and William Woods, representing pharmaceutical manufacturers.

► "STAPHCILLIN—A New Penicillin for Resistant Staphylococci" is the name of a film produced by Bristol Laboratories. It illustrates graphically how resistant staphylococcus germs succumb to the new synthetic penicillin, Staphcillin. The 18-minute color motion picture film will eventually be made available for showings to hospital staffs and group meetings.

► Ugo Caruso, formerly chief pharmacist at Grace—New Haven Community Hospital, has accepted a position as chief pharmacist at Fairfax Hospital in Falls Church, Virginia. Mr. Caruso is a graduate of the Philadelphia College of Pharmacy and Science and served an internship in hospital pharmacy at the Jefferson Medical College Hospital in Philadelphia.

Kremers-Urban Sponsors History Award

An Edward Kremers Award to stimulate top level writing of the history of pharmacy among American writers has been established by the American Institute of the History of Pharmacy under an annual grant to be made by the Kremers-Urban Company. The Milwaukee drug manufacturer thus helps to commemorate a learned pioneer of historical work in American pharmacy, who also usually is considered one of the men most influential in American pharmaceutical education during his lifetime (1865-1941), the Institute points out.

Ray A. Johns, president of the Kremers-Urban Company, said, "It seemed to us that history has something important to say to us in the pharmaceutical field specifically, just as it does in other segments of life. That is because we must live by and for more than the present moment or an unforeseeable future. So we are glad to make true the dream of the American Institute of the History of Pharmacy to have an award of this kind," Mr. Johns added.

"We do it partly to help raise the sights of pharmacist-writers to the best historical work of which they are capable," Mr. Johns concluded. "And partly we do it to keep before us all the luster of what was achieved by Edward Kremers, a scion of the same family that gave us two founders of our own firm, Ernst and John Kremers."

A check for conferral of the first award was presented by the Kremers-Urban Company at the Institute's annual meeting in Chicago on April 25. The Treasurer of the American Institute of the History of Pharmacy, Sylvester H. Dretzka, indicated that Kremers-Urban expects to give $2000, over a period of years, to permit the award to be made annually.

A special committee and the executive council of the Institute already have brought a plan and criteria for such an award to final form in 1960, Mr. Dretzka said. The Kremers Award will be bestowed upon an American citizen "for an original publication or series of related articles (not excluding unpublished manuscripts) pertaining primarily to historical or historico-social aspects of pharmacy. There will be an expert committee," he noted, "to judge the entries on the basis of competence of research, interpretation and presentation."

An official form upon which to recommend a candidate for the first Edward Kremers Award may be obtained by request to the Institute's Secretary, Ernst W. Stieb, 356 Pharmacy Building, Madison 6, Wisconsin, and must be returned before December 31.

The first Geigy Leadership award "created to honor Pharmacists in hospital practice for demonstrated qualities of leadership," was presented to Clifton J. Latiolais (right), president of the American Society of Hospital Pharmacists (1960-1961) by Al Mannino, director of hospital sales, Geigy Pharmaceuticals. The award, an inscribed bronze mortar with a pestle which can be used as a gavel, symbolizes the leadership demonstrated by Mr. Latiolais in hospital pharmacy activities. Mr. Mannino said that the award will be presented to all presidents of Affiliated Chapters of the Society

► "Hospital Pharmacy—A Rapidly Growing Professional Specialty" is the title of a brochure recently made available by the School of Pharmacy at the University of Georgia, Athens. Designed to create interest in hospital pharmacy practice, the brochure outlines the varied opportunities in—the civilian hospital, the military services, the U. S. Public Health Service, the Veterans Administration, and in hospital administration. Also opportunities with particular attention to training in hospital pharmacy are outlined.

► Edward F. Keating, manager of trade relations of Merck Sharp and Dohme, has undertaken a series of speaking engagements at U. S. universities to help inform pharmacy students about careers available to trained graduates. Mr. Keating's discussion covers opportunities in retailing, wholesaling, and industry, the latter including careers in manufacturing, research, quality control, sales, and marketing.

Mr. Keating is widely known as a speaker, and his career has included long experience in the pharmaceutical industry, as well as operation of a retail pharmacy in Chicago for twelve years. He was president of the American College of Apothecaries in 1959-60, and has subsequently served as chairman of its board of directors.

SELECTED PHARMACEUTICAL ABSTRACTS

and summaries of other articles interesting to hospital pharmacists

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edited by NORMAN HO

PHYSICS AND HOSPITAL PHARMACY

Physics and the Hospital Pharmacist, (Part I) Introduction, Sykes, C. H., M & B Pharmaceut. Bull. 10:9 (Jan.) 1961. (London Hospital, London, England).

The article deals with some of the phenomena of gases and vapor pressure as exhibited by air, water, and alcohol vapors. It describes how a pharmacist can prepare a source of vacuum and compressed air using a one liter round-bottomed boiling flask, a yard of small gauge pressure tubing, two spring clips, and a one-gallon metal can. The author also presents a simple method for the removal of small air bubbles from urethral lubricant jellies used for cystoscopic and resectoscopic ward, and a means of lowering the danger of explosion when autoclaving 95% industrial methylated spirit on 2-liter amounts.

LAWRENCE J. RASERO, JR.

PHYSICS AND HOSPITAL PHARMACY

Physics and the Hospital Pharmacist (Part II), Heat, Light, and Sound, Sykes, C. H., M & B Pharmaceut. Bull. 10:17, (Feb.) 1961, (London Hospital, London, England).

A review of the physical principles involving refrigeration, liquefied and solidified gases, ultraviolet light and the destruction of organisms, actinic destruction of compounds, and ultrasonic vibration has been presented. The manner in which heat is removed from a chamber, and the correct storage of certain pharmaceutical products was also described. It was stated that the basic physics of the pressurized aerosol pack is the same as that of the autoclave. In each case, the operational temperature was the boiling point of the liquid used and so the internal pressure in the vessel is above that of the external air. The liquid used for pressurized aerosols must have certain characteristics. It must boil at atmospheric pressure; it must be inert; its vapor must be non-toxic to the user; and it must have low viscosity. In describing the manner by which ultraviolet light destroys organism, the author reported that ultraviolet light produces hydrogen peroxide within the bacterial cell and will kill the cell if no peroxidase enzymes are present. The basis for use of ultrasonic vibration for cleaning metals immersed in grease solvents, for mixing powdered materials, and for making emulsions was also mentioned.

LAWRENCE J. RASERO, JR.

COLORIMETRIC DETERMINATION OF CHLORAL HYDRATE

A New Colorimetric Method for the Determination of Chloral Hydrate, Archer, A. W. and Haugas, E. A., J. Pharm. Pharmacol. 12:754 (Dec.) 1960. (Smith and Nephew Research Ltd., Hunsdon Laboratories, Ware, Herts, England).

A colorimetric method is described for the determination of chloral hydrate, particularly in the presence of its decomposition products, i.e., trichloroacetic acid, formic acid, hydrochloric acid, and possibly chloroform. Conventional macro methods, based on alkaline hydrolysis or total chlorine determination, are subject to interference from its decomposition products. These products do not react under the conditions described for the colorimetric method. Quinaldine ethiodide reacts with the chloral hydrate in solution, made alkaline with ammonia or ethanolamine, to produce a stable, blue cyanine dye. The color produced conforms to the Lambert-Beer law up to 100 ug./10 ml. of reaction mixture.

NORMAN HO

CHEMICAL PURITY AND GRADES

The Purity Chemicals Industry and Parenteral Drug Manufacturing, Kleppinger, C. T., Bull. Parent. Drug Assoc., 15:21 (Jan.-Feb.) 1961. (J. T. Baker Chemical Co., Phillipsburg, N. J.).

The many grades of chemical purity are discussed. Chemicals of pharmaceutical grade designations, *U.S.P.* and *N.F.*, meet the applicable requirement of the current *United States Pharmacopeia* and *National Formulary*. Specifications generally include assay and control of arsenic and heavy metals content, and of other substances, which, if present might be deleterious in drug use.

Reagent grade chemicals conform to the specifications of the American Chemical Society for maximum limits of purity and minimum assay. Generally, chemical producers control many critical impurities to levels more stringent than required and additional impurities not specified and also certain physical properties such as particle size, color, solubility, etc. The extent of the purity of the reagent chemical is dictated by its principal use. Such chemicals, which are expected to find medicinal use, are usually specified for arsenic and lead.

Chemicals, which do not quite meet the stringent reagent specifications, but which are still suitable for routine laboratory and industrial applications, are defined as chemically pure (C.P.). Specifications are labeled in terms of minimum standards of purity.

Chemicals classified as "Purified," "Practical" or "Fine" generally include organic and inorganic compounds suitable in synthetic work or in many solvent applications and are of good quality in the absence of official standards. Specifications are generally not shown on the label. Other grades mentioned are the primary standard and biological grades.

NORMAN HO

DETERMINATION OF SUSTAINED ACTION

Experimental Determination of Sustained Action, Myers, E. L., Drug & Cosmetic Ind. 87:622 (Nov.) 1960. (New Drug Branch, Bureau of Medicines, Food and Drug Administration, Washington, D. C.)

Section 502 (a) of the Food, Drug and Cosmetic Act defines a drug as misbranded if its labeling is false or misleading in any particular. It could further be stated that sustained-action dosage forms are misbranded unless they furnish the sustained therapeutic effect they are represented to have in their labeling. Unsafe overdosage could result if such products are improperly made. Because of the many variables encountered by an oral drug, it is difficult to devise a sustained-action preparation which will have a uniform time of disintegration and absorption from patient to patient. Each patient, in a sense, is a variable unto himself. It is desirable that an established and standardized *in vitro* method of testing be employed to control the article during manufacture. Due to the fact that there are a variety of forms of sustained-action preparations, it is expected that there will also be a variety of *in vitro* tests established. Procedures and equipment for some nine *in vitro* testing methods are outlined. The F.D.A. has not checked sustained-action drugs clinically for regulatory purposes; however regulatory actions have been taken based on *in vitro* tests showing extreme variation of certain drugs from the labeled claims. The variations have been of two types: (1.) the preparation releases the drug more rapidly than the label claims or (2.) it releases the drug less rapidly. The final criterion for evaluating a sustained-action preparation is its clinical effectiveness. The primary purpose of further studies will be to develop the least number of generally accepted and useful procedures to adequately control the uniformity of sustained-action drugs.

FRANZ W. GEISZ

BACTERICIDAL ACTIVITY OF FORMALDEHYDE VAPOR

Importance of the Presence of Moisture on the Bactericidal Action of Formaldehyde, Rao, V., Indian J. Pharm. 22:253 (Oct.) 1960. (Department of Pharmacy, Andhoa University, Waltair, India).

Bactericidal activity of formaldehyde vapor, passing through powders contaminated with *B. subtilis* spores, decreased as the relative humidity varied from 98 to 65%. The death rate of the organisms depended upon the quantity of formaldehyde in the moist vapor passing through the powder per minute. Formaldehyde vapor in varying concentrations by dilution with moist air did not indicate any reduction in activity, but dilution of for-

maldehyde vapor with dry air considerably reduced the death rate. It was further found that certain optimum moisture content is essential for efficient bactericidal activity.

NORMAN HO

CORTICOSTEROID MANUFACTURING

Formulation and Manufacture of Corticosteroid Preparations, R. E. Collard, Pharm. J. 186:113 (Feb. 11) 1961. (Boots Pure Drug Co. Ltd., Great Britain).

A review of the properties, stability and formulation of the currently used corticosteroid preparations is presented along with some of the problems involved in their manufacture. The properties of the compounds which influence formulation and present processing problems are discussed. Chemically, there are two centers in the steroid molecule which are likely to undergo degradation in formulated products. Some factors which may speed this are light or solutions which are neutral or slightly acid. The preparation of topical ointments is discussed with particular emphasis on bases. Generally, it seems that an emulsion base is preferred, although an anhydrous greasy base or a hydrophilic base may be used. For the soluble esters, an anhydrous base is most commonly used because of the side chain degradation usually occurring in water. Eye ointments and topical lotion preparations are discussed. Tablets present fewer problems than the other dosage forms, although their hazard to peptic ulcer patients has prompted their combination with antacids. This causes some possible incompatibilities such as those with magnesium trisilicate and magnesium oxide. With the efficiency of hydrocortisone in the local treatment of ulcerative colitis, some rectal preparations have been formulated. In parenteral preparations one of the problems is the selection of a proper solvent-solute combination which will not cause degradation. The use of the dry powder to be placed in solution or suspension avoids this. Suitable preservatives and buffers are listed. Eye drops are similar to parenteral preparations except a wider range of preservatives is used and additional attempts to solubilize the corticosteroids are employed using such agents as the Tweens and Tritons. The pharmacological actions of the corticosteroids in hay fever and asthma suggest their use in inhalations either as a powder or in aerosols.

Particle size is an important consideration in the preparation of topical ointments, eye ointments, lotions, parenterals, eye drops and inhalations. Coarser materials would be less active and slower in action. The author suggests that one area to which the pharmaceutical industry might now turn its attention is in the preparation, classification and use of compounds in the micron and sub-micron range. This article also contains 31 references pertaining to most of the problems in corticosteroid manufacturing.

LEONARD C. SISK

COMPOUNDING ACCURACY

Stock Solutions in Dispensing, K. R. Capper, F. G. Farrell and G. Smith, Pharm. J. 132:23 (Jan. 14) 1961. (Department of Pharmaceutical Sciences, Pharmaceutical Society of Great Britain).

A series of experiments were conducted to determine the accuracy of stock solutions and the possible errors which their use might introduce into the final preparation. Officially, an allowance of $\pm 5\%$ for dispensing variations is made. A number of standard solutions were obtained from the regular shelf stock of various pharmacies. When analyzed 9 out of 10 were within the limits. A number of pharmacists experimentally measured and calibrated a winchester quart or 80 fl. oz. and were able to make measurements in the range of $\pm 2\%$ suggesting then that an accuracy of $\pm 2\%$ could have been obtained with due precaution in the preparation of the stock solutions. An additional possible error is introduced when the stock solution is measured for the final prescription. Since frequently 1 or 2 fl. oz. of the stock solution is used a number of pharmacists made a series of measurements with 1 fl. oz. and 2 fl. oz. graduates. The limits of error were estimated at $\pm 4.4\%$. Graduates officially are allowed tolerances of $\pm 1.2\%$ and $\pm 0.9\%$ for 1 fl. oz. and 2 fl. oz. respectively. The summation of all these errors gives a range of $\pm 7.5\%$. In practice the error is reported to frequently exceed $\pm 5\%$; however, the results of tests under the "Drug Testing Scheme" show that few mixtures exhibit errors of the degree which might be expected. This may be due in part to some operations cancelling the error of others. Thus, with stock solutions, a reasonable tolerance for the amount of solids so dispensed would seem to be $\pm 7.5\%$ although the official tolerance of $\pm 5\%$ is reasonable if good pharmaceutical practice is followed.

LEONARD C. SISK

DEVELOPING AND TESTING NEW DRUGS

Developing and Testing of New Drugs by the Pharmaceutical Industry, Kohlstaedt, Kenneth G., Clin. Pharmacol. Therap. 1:192 (Mar.-Apr.) 1960. (Lilly Laboratory for Clinical Research, Marion County General Hospital, Indianapolis, Indiana).

The developing and testing of new drugs is an important responsibility of the pharmaceutical industry. The first tests are "screening" procedures that are intended to uncover leads indicating possible therapeutic usefulness. After thorough pharmacologic and toxicity testing in experimental animals, a new drug is ready for the initial trial in a human subject.

It is practical for a pharmaceutical manufacturer to maintain a clinical research unit and a staff of investigators for performance of the initial human trials. A new therapeutic agent is then placed in the hands of a limited number of experienced and qualified investigators so that adequately controlled studies can be conducted under close observation. In some instances, as a final evaluation, the drug is subject to a broad clinical trial by a large number of physicians. If properly conducted, important information can be obtained by the use of a drug under conditions found in the practice of medicine. Evidence of hypersensitivity cannot be detected by limited trial. The clinical investigator must plan the study with great attention to detail. Every effort must be made to avoid bias.

In the development of the drug, the work of the pharmaceutical chemist is important in preparing a satisfactory dosage form; the control division must establish criteria for the composition of the ingredients as well as for the final product and must prove the stability. Publication of reports in the scientific journals must include methods and controls for clinical studies and the results. A group of investigators can use one experimental design and pool the findings in a single paper. The investigator should report all data to the manufacturer as quickly as possible.

AUTHOR'S SUMMARY

CURRENT LITERATURE

. . . also calling your attention to the following articles appearing in recent hospital and pharmaceutical journals

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ADMINISTRATION
—Costs

Bowles, Grover Jr.: Pharmacist has Important Role in Keeping Drug Costs Reasonable, *Modern Hosp.* 96:134 (Mar.) 1961.

Bowles, Grover Jr.: Ten-Point Review Can Reduce Costs of Operating Pharmacy, *Modern Hosp.* 96:129 (Apr.) 1961.

AMERICAN SOCIETY OF HOSPITAL PHARMACISTS
(Includes Affiliated Chapters)

Anon.: Hospital Pharmacists Focus on Changing Role, Control Procedures (Report of 1961 Annual Meeting of ASHP), Formulary Service, *Hospitals* 35:110 (May 16) 1961.

Vance, Joe: Conventions Highlight Busy Month (Program of Southeastern Society of Hospital Pharmacists meeting in Memphis), *South. Hosp.* 29:53 (Apr.) 1961.

INTERNATIONAL

Anon.: Irish Hospital Rx Men Gripe at their Tax-Collecting Role (Life under Socialized Medicine), *Am. Profess. Pharmacist* 27:50 (Apr.) 1961.

LIBRARY AND REFERENCE

Miller, Edwin B., Sr.: We Maintain Literature Sub-Depots for MDs and Nurses in Our Hospital, *Am. Profess. Pharmacist* 27:50 (Apr.) 1961.

PARENTERAL SOLUTIONS
(Includes Pharmacy-Central Supply, Sterilization Procedures)

Anon.: Nine Examples of Central Service Planning, *Modern Hosp.* 96:94 (Mar.) 1961.

Barton, Jane: How Central Service Deliveries the Goods, *Modern Hosp.* 96:87 (Mar.) 1961.

Anon.: Special Report: Planning Central Service, *Modern Hosp.* 96:79 (Mar.) 1961.

Cravitz, Leo, and Tyler, Virginia: Gas Sterilization Adds to Life of Surgical Gloves, Tests Show, *Modern Hosp.* 96:106 (May) 1961.

Struve, Mildred and Levine, Eugene: How Disposable and Reusable Gloves Compare, *Modern Hosp.* 96:111 (May) 1961.

DRUG EVALUATIONS

by the Council on Drugs of the American Medical Association

► DRUG EVALUATIONS as published by the Council on Drugs of the American Medical Association have been reprinted in the AMERICAN JOURNAL OF HOSPITAL PHARMACY regularly. In accordance with an editorial in the December 17 (1960) issue of the *Journal of the American Medical Association 174*:2066, the column formerly known as "New and Nonofficial Drugs" has been replaced by a new column under the name "New Drugs and Developments in Therapeutics." In this, a digest of monographs and drug evaluations will appear.

The monographs will continue to be made available and will be cumulated to appear in the Council's annual publication, *New and Nonofficial Drugs*. For the information of hospital pharmacists, reports made available by the A.M.A.'s Council on Drugs will continue to be published in this column.

The Index included in the February issue of THIS JOURNAL contained reference to those drugs published in the *Journal of the American Medical Association* between October 24, 1959 and December 17, 1960. These monographs were reprinted in THIS JOURNAL between February 1960 and January 1961. All appear in *New and Nonofficial Drugs 1961*, which is now available from either your local book store or from the publishers, J. B. Lippincott Company, Philadelphia, Pa. This makes up the annual compilation of available information on drugs, including their therapeutic, prophylactic and diagnostic status, as evaluated by the Council on Drugs of the American Medical Association.

For the convenience of readers of THIS JOURNAL, a listing of the monographs added to N.N.D. 1961 as well as the monographs omitted from N.N.D. were listed in the March issue of THIS JOURNAL. With that issue, publication of the new series was also started.

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208 WITHDRAWAL OF IRON-DEXTRAN COMPLEX (IMFERON) (Mar.)

COUNCIL ON DRUGS

*A Council on Drugs' Digest**

New Drugs and Developments in Therapeutics

Dextriferron — Astrafer®

Summary of Council Opinion

DEXTRIFERRON (Astrafer) is a hematinic for the treatment of iron deficiency anemia which must be administered intravenously. Hematological responses to dextriferron are quantitatively equal to those of other iron preparations administered intravenously, but it is apparently better tolerated than saccharated iron oxide. However, the advantages of intravenous administration of iron do not outweigh those of the intramuscular or oral routes when these are possible. While the oral route is the method of choice for the great majority of cases of iron deficiency anemia, intravenous iron has a definite place in certain special situations.

Chemistry

Dextriferron is a colloidal solution of ferric hydroxide in complex with partially hydrolyzed dextrin. The solution, containing 20 mg. iron per cc., has a *p*H of 7.6±0.3, and it is stable for periods up to two years.

Actions and Uses

Dextriferron, an iron-carbohydrate complex differing in composition from saccharated iron oxide and iron-dextran complex, is a preparation used for the intravenous administration of iron in the treatment of patients with iron deficiency anemia. Results of the clinical use of dextriferron have demonstrated that it provides a readily available source of iron for hemoglobin synthesis, the iron being utilized almost quantitatively for this purpose. Reports on the hematological responses to dextriferron compare favorably with those on other iron preparations administered intravenously; they demonstrate that hemoglobin regeneration is more rapid after intravenous administration of iron than after oral administration. Following administration of dextriferron the hemoglobin concentration increases, after a latent period of 3 to 7 days, at a rate inversely proportional to the initial value. The

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Monographs on which this digest is based will be compiled and published annually in *New and Nonofficial Drugs;* interim copies of the complete monographs may be obtained on request from the Secretary, Council on Drugs, American Medical Association, Chicago.

Scientific data were supplied to the Council by Astra Pharmaceutical Products, Inc. (dextriferron); Cutter Laboratories (plasma protein fraction, human); Endo Laboratories Inc. (oxymorphone hydrochloride); E. Fougera and Company, Inc. (bunamiodyl sodium); and Mead Johnson & Co. (methdilazine hydrochloride).

***The above is the complete report as made available by the Council on Drugs of the American Medical Association. The Digest on Dextriferron appeared in the *J. Am. Med. Assoc. 175*:1170 (Apr. 1) 1961.**

increase in serum iron concentration depends on the degree of repletion of the iron stores; a normal value is not reached until sufficient iron is given to cause regeneration of hemoglobin and restoration of the iron storage depots. Maximum reticulocyte response occurs during the first week of therapy and remains high for some time. In addition to the hematological responses, epithelial symptoms associated with iron deficiency anemia are improved when dextriferron is administered.

As with other iron preparations given parenterally, the indications for the use of dextriferron are limited, but definite. Dextriferron should be used only in patients with an established diagnosis of iron deficiency anemia when oral therapy is ineffective or impracticable. It is indicated for those patients (1) who refuse or cannot tolerate iron when given orally, (2) in whom oral administration of iron is contraindicated because of gastrointestinal complications, e.g., ulcers, regional enteritis, and colitis, (3) who are unable to absorb an adequate amount of iron given orally, (4) in whom maximum speed of hemoglobin restoration is required, such as in iron deficiency anemia discovered late in pregnancy with insufficient time for adequate oral therapy, and (5) in patients with severe hemorrhage for whom transfusions are undesirable or unavailable. It is emphasized that, in addition to providing replacement iron therapy, the cause of the iron deficiency should be sought and appropriate steps taken to correct it.

Side Effects

Untoward effects associated with dextriferron are rare, but they may occur as either early or delayed reactions. The early reactions, which usually result from too rapid injection, include flushing of the face, nausea, headache, and abdominal pain. Delayed reactions consist of a sensation of stiffness in the arms, legs or face, chills, and increased temperature. Accidental paravenous injection was reported to cause a mild inflammatory reaction which required no special treatment and subsided in 24 to 48 hours without any tissue damage. No thrombophlebitis has been reported, although the same vein was used for repeated injections in some cases. No allergic symptoms have been observed.

Dextriferron has a relatively low acute toxicity and is generally well tolerated in experimental animals. After intravenous administration to rabbits, the iron content of the liver and spleen increased significantly but was subsequently observed to decrease. Histological examination of the tissues revealed no proliferation of connective tissue or other damage, even after high doses for periods up to one year after injection of the iron. Thus, it is unlikely that induced hemochromatosis will result from the intravenous administration of dextriferron unless excessive amounts are given. Nevertheless, since the excretion of iron in man is slight and tissue damage may result from an excess storage of iron, the physician should use care in determining the amount of iron administered intravenously.

Route of Administration

Intravenous.

Dosage

The total dose of iron required is calculated on the basis of the patient's hemoglobin concentration. Approximately 150 mg. of iron is required to increase hemoglobin values 1 Gm. per 100 cc. of blood, or 25 mg. of iron is needed for each 1% deficiency in hemoglobin concentration, assuming 100% hemoglobin to be normal. An additional amount should be provided to replace stored iron, which has been estimated by various investigators to be from 250 mg. to 1 Gm.

The total calculated dose is given over a period of several days beginning with a dose of 1.5 cc. of a 2% solution (30 mg. of iron) and increasing this by 1 to 1.5 cc. (20 to 30 mg. of iron) on subsequent days, up to a total daily dose of 5 cc. (100 mg. of iron). The maximum daily dose should not be more than 5 cc. of a 2% solution (100 mg. of iron). Administration of dextriferron is continued only until hemoglobin values reach the normal range, even though the total calculated dosage has not been given.

Precautions

Dextriferron is not effective and is contraindicated in patients with pernicious anemia, hemolytic anemia, acute leukemia in the absence of iron depletion by blood loss, anemia associated with chronic leukemia or bone marrow depression, and in the treatment of patients with other anemias not resulting from iron deficiency. It is contraindicated in patients with severe liver damage.

Dextriferron should be given only by the intravenous route and at a slow rate (not more than 5 cc. of a 2% solution in 2 minutes). It is advisable to have the patient rest for 15 to 30 minutes after each administration. A single dose should not exceed 5 cc. of a 2% solution (100 mg. of iron), since a higher incidence of side effects has been reported after the administration of higher doses. If the desired results are not obtained with the calculated dosage, therapy should be discontinued and a possible complicating illness should be suspected. As a safeguard against an excessive dosage, probably no more than 2 Gm. of iron should be given during one period of treatment. A second course is not indicated unless an excess iron loss is proved. As a further precautionary measure against an overload of iron, a microscopic examination of the bone marrow for hemosiderin should be performed before a second course is given.

Preparations

Solution (injection) 100 mg. of iron in 5 cc.

Commercial Sources

Astra Pharmaceutical Products, Inc.

Year of introduction: 1958.

This monograph will be included in the 1962 edition of the Council on Drugs' annual publication, *New and Nonofficial Drugs.*
Evaluated By A.M.A. Council on Drugs—October 5, 1960

POSITIONS

in hospital pharmacy

PERSONNEL PLACEMENT SERVICE

The Personnel Placement Service is operated without charge for the benefit of hospitals and pharmacist members of the American Pharmaceutical Association and the AMERICAN SOCIETY OF HOSPITAL PHARMACISTS. The ultimate purpose is the improvement of pharmaceutical services in hospitals, by more adequately fulfilling hospital pharmacy personnel needs and by locating positions which provide challenging opportunities for pharmacists who have indicated an interest in a hospital career.

By participating in the service, the hospital indicates a desire to achieve a pharmaceutical service which meets the *Minimum Standard for Pharmacies in Hospitals.* A description of the position should be submitted to the Division of Hospital Pharmacy on the forms provided. The hospital will receive applications directly from the applicant. The hospital agrees to reply to each application received and to notify the Division of Hospital Pharmacy when the position is filled.

The pharmacist, by participating, agrees to submit a Personnel Placement Service Information Form to the Division of Hospital Pharmacy. The applicant will then be notified of openings listed with the Service as they become available and can negotiate directly with the hospital if he is interested. It is agreed that the Division of Hospital Pharmacy will be notified as soon as a position is accepted.

A listing of positions open and wanted will be made regularly in the AMERICAN JOURNAL OF HOSPITAL PHARMACY without charge. Neither the name of the hospital offering the position nor the name of the applicant will be listed, except by code. All inquiries should be directed as shown below, including the code number.

Address all inquiries to

Division of Hospital Pharmacy
2215 Constitution Avenue, N. W.
Washington, 7, D. C.

positions open

STAFF PHARMACIST—300 bed general hospital. Duties include filling inpatient and outpatient prescriptions, maintaining records, filling floor stock medications. Must have B. S. and be registered or eligible for registration in Pennsylvania. Forty hour week. Liberal benefits. PO-282

CHIEF PHARMACIST—120 bed general hospital. Applicant will be responsible for complete operation of pharmacy dept., including purchasing. Must be registered in Missouri. Forty hour week. Liberal benefits. PO-281

CHIEF PHARMACIST—190 bed general short-term hospital located in Michigan. Duties include purchasing and dispensing drugs, assist in teaching student nurses. Hospital pharmacy experience. Forty-two hour week, vacation, sick leave and retirement plan. PO-280

STAFF PHARMACIST—280 bed general short-term hospital located in Texas. Duties include filling of inpatient and outpatient prescriptions, floor stock, and maintaining records. Must be registered. Forty hour week. Liberal personnel policy. PO-279

STAFF PHARMACIST—300 bed general short-term hospital. Duties include inpatient and outpatient dispensing, bulk compounding and manufacturing, sterile preparations and control. Male preferred. Must have B. S. and be eligible for registration in Michigan. Forty hour week. Liberal benefits. PO-278

STAFF PHARMACIST—285 bed general hospital located in Indiana. Duties include compounding prescriptions, and dispensing manufactured drugs. Must be registered. Forty to forty-four hour week, vacation, sick days and retirement plan. PO-277

STAFF OR ASST. CHIEF PHARMACIST—300 bed hospital located in Indiana. Duties include compounding and dispensing medicines, assist in purchasing, maintaining records, furnishing information on medications. Must have B. S. and be eligible for registration in Indiana. Female preferred with experience. Forty hour week, vacation, sick leave, excellent personnel policy. PO-276

CHIEF PHARMACIST—313 bed general hospital located in Kentucky. Duties include planning and coordinating pharmacy, directing and training pharmacy personnel and possibly some teaching. Forty hour week, liberal benefits. PO-275

STAFF PHARMACIST—560 bed general hospital. Duties include inpatient dispensing with some clinical outpatient service, bulk compounding including preparation of sterile solutions. Must have B. S. and be registered or eligible for registration in Texas. Forty-four hour week. Liberal benefits. PO-274

STAFF PHARMACIST—354 bed general hospital. Must be registered or eligible for registration in Indiana. Forty hour week, liberal benefits. PO-273

CHIEF PHARMACIST—143 bed general hospital in Iowa. Applicant will be responsible for complete operation of pharmacy department, including dispensing, inpatient and outpatient drugs, advising staff physicians and purchasing. Forty hour week. Liberal benefits. PO-272

ASST. CHIEF PHARMACIST—212 bed general hospital. Duties include filling stock orders for nursing stations and other related duties. Must be registered in Illinois. Female preferred. Forty hour week. Liberal personnel policy. PO-271

ASST. CHIEF PHARMACIST—130 bed general hospital located in Louisiana. Duties include compounding and dispensing drugs and related items, furnishing information to nurses and doctors, maintaining records, and assisting in purchasing and general management of the department. Forty hour week, vacation, hospitalization and sick leave. PO-270

STAFF PHARMACIST—350 bed general hospital. Duties include prescriptions, preparing floor supplies and stock solutions, maintaining records and other related duties. B. S. and registration in Missouri required. Forty hour week, liberal employee benefits. PO-266

DIRECTOR, PHARMACEUTICAL SERVICES—600 bed general teaching hospital. Assume responsibility for pharmacy, central sterile supply, and teaching to School of Nursing and professional staffs. Must be eligible for Ohio registration. Liberal employee benefits. PO-264

CHIEF PHARMACIST—185 bed general hospital located in Virginia. In charge of pharmacy, purchasing, personnel, dispensing and other controls. B. S. required, and at least one year's experience. Forty-four hour week, vacation. PO-262

STAFF PHARMACIST—950 bed general hospital. Duties include filling prescriptions and some manufacturing. Registration in Minnesota required. Forty hour week, vacation, and other benefits. PO-261

STAFF PHARMACIST—400 bed general hospital. New hospital scheduled to open summer 1961. Duties include compounding and dispensing drugs, medicines and pharmaceutical supplies. Supervising prepackaging program, small out-patient clinic. B. S. and registration in Ohio required. Forty hour week, vacation. PO-260

STAFF PHARMACIST—450 bed hospital in New Jersey. Duties include compounding and dispesing medicines and preparations, preparing and sterilizing injectible medications manufactured in hospital and other related duties. Male or female. Forty hour week, liberal personnel policies. PO-259

STAFF PHARMACIST—700 bed University teaching hospital. Duties include inpatient and outpatient dispensing. B.S. required. Must be registered or eligible for registration in Wisconsin. Forty hour week, vacation and insurance program. PO-255

ASST. CHIEF PHARMACIST—317 bed general hospital located in Delaware. Duties include assisting chief pharmacist in carrying out procedures and policies. Male preferred with internship, preferably M. S. Degree. Forty hour week, vacation and liberal personnel policies. PO-254

STAFF AND ASST. CHIEF PHARMACISTS—600 bed general hospital located in suburb of Chicago. Filling patient prescriptions. Forty hour week. Excellent personnel policies. PO-252

REGISTERED PHARMACIST—154 bed general hospital primarily for care of Samoan People. Complete charge. Free medical and hospital care. Ten weeks' paid leave at termination of two year contract. Single person preferred. Send resume, experience, education, availability and salary requirements to: Personnel Officer, Government of American Samoa, Pago Pago, American Samoa.

STAFF PHARMACIST—237 bed general hospital. Duties include filling patient drug orders, outpatient prescriptions and assisting chief pharmacist. B. S. Degree and registration in Iowa required. Forty hour week, vacation and sick leave. PO-250

STAFF PHARMACIST—525 bed general hospital located in Ohio. Duties include filling prescriptions for patients, floor stock and clinic patients. Must be registered in Ohio. Forty hour week, vacation and personnel policies. PO-249

STAFF PHARMACIST—700 bed general hospital. Duties include dispensing drugs from the central and clinic pharmacies. Registration in Georgia required. Male or female. Liberal personnel policies. PO-245

STAFF PHARMACIST—275 bed private hospital in Chicago. Applicant will compound and dispense drugs and medicines. Must be licensed in Illinois. Forty hour week, vacation, and other liberal benefits. PO-243

STAFF PHARMACIST—520 bed general private hospital. Duties include compounding and dispensing medicines and preparations according to prescriptions. Female preferred. Must be registered or eligible for registration in Washington State. Forty hour week, vacation and other liberal benefits. PO-242

ASST. CHIEF PHARMACIST—650 bed general hospital located in Nebraska. Duties include refilling patient orders, floor supplies for nursing stations and compounding supplies. Forty hour week, vacation. PO-236

STAFF PHARMACIST—350 bed general hospital. Applicant will assume some supervisory responsibility. B. S. required. Must be registered or eligible for licensure in Ohio. Forty hour week, vacation, sick leave, holidays and group hospitalization. PO-235

CHIEF PHARMACIST—120 bed general hospital located in Kansas. Pharmacist will organize pharmacy dept., and assist in teaching pharmacology to student nurses. Must be registered or eligible for licensure. Forty-four hour week, vacation and other liberal benefits. PO-230

STAFF PHARMACIST—550 bed teaching hospital located in Virginia. No experience necessary. Female preferred. Forty hour week, vacation and liberal benefits. PO-226

CHIEF PHARMACIST—Psychiatric hospital located in Ohio. Must be registered in Ohio. Forty hour week, vacation and retirement benefits. PO-221

ASST. CHIEF PHARMACIST—204 bed hospital. Duties include dispensing, receiving and labeling drugs, etc., furnishing information to physicians and nurses; teaching student nurses; and being responsible as an assistant department head in administrative and other related duties. Forty hour week, vacation and sick leave. Must be eligible for registration in Illinois. PO-203

CHIEF PHARMACIST—104 bed general hospital. Direct pharmacy with the help of full-time registered nurses and assist in the purchase of medical surgical supplies. Forty hour week, vacation and sick leave. Located in a University town in Illinois. PO-202

STAFF PHARMACIST—790 bed hospital. Duties include handling and filling of inpatient and outpatient departmental orders, outpatient prescriptions and bulk manufacturing. Must be registered or eligible for registration in Ohio. Male preferred. Forty hour week, vacation, holidays and pension plan. PO-194

CHIEF PHARMACIST—2300 bed mental hospital. Pharmacist will have complete charge of pharmacy, drug orders, stocking, dispensing, compounding necessary records and other pharmacy duties. Must be licensed in Ohio. Forty hour week. Vacation, holidays, insurance, retirement plan and sick leave benefits. PO-189

CHIEF PHARMACIST—264 bed general hospital located in Texas. Plans and directs pharmacy policies, compounds and dispenses medicines, purchases supplies and materials, maintains records, and prepares periodical reports. Must be eligible for or have M. S. Degree. Forty hour week, vacation, retirement, sick leave and insurance plan. PO-177

STAFF PHARMACIST—200 bed general hospital. Duties include compounding, dispensing and manufacturing. Applicant must have B. S. in Pharmacy and be registered in Connecticut. Recent graduate acceptable. Forty-four hour week, vacation, pension plan and hospitalization. PO-168

ASST. CHIEF PHARMACIST—280 bed general hospital. Duties include filling prescriptions and medication orders from various units, supervise pharmacy clerks, assume administrative responsibility when chief pharmacist is absent. Forty-four hour week, sick leave and holidays. Must be registered in Illinois. PO-161

STAFF OR ASST. CHIEF PHARMACIST—150 bed general hospital located in New Mexico. Generous benefits. PO-134

STAFF PHARMACIST—500 bed general hospital located in Oklahoma. B. S. required. Forty hour week. PO-95

ASST. CHIEF PHARMACIST—237 bed general hospital in West Virginia. Female desired. Forty-four hour week, vacation. PO-77

positions wanted

CHIEF PHARMACIST—Male, married. Obtained B. S. in 1952. Hospital pharmacy experience. Prefers to locate in the West, Northwest, Kentucky or Washington, D.C. Registered in Kentucky. PW-337

STAFF PHARMACIST—Male, married. Will obtain B. S. in May 1961. Hospital pharmacy experience. Will locate anywhere. Registered in Ohio. PW-336

STAFF PHARMACIST—Male, married. Obtained B. S. in 1952. Prefers to locate in Florida. Registered in Maine and Massachusetts. PW-335

CHIEF PHARMACIST—Male, married. Obtained B. S. in 1953. Seven years' hospital pharmacy experience. Served hospital pharmacy internship. Prefers to locate in the Southeast or Southwest. Registered in North Carolina. PW-334

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained B. S. in 1954. Three years' hospital pharmacy experience. Prefers to locate in the West or East. Registered in Pennsylvania. PW-333

ASST. CHIEF OR CHIEF PHARMACIST—Female, married. Obtained B.S. in 1958. Hospital pharmacy internship. Two years' hospital pharmacy experience. Prefers to locate in Florida. Registered in Florida and Alabama. PW-332

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained B.S. in 1960. Hospital pharmacy experience. Prefers to locate on the East Coast. Registered in Florida and Georgia. PW-331

STAFF OR ASST. CHIEF PHARMACIST—Male, married. One year's hospital pharmacy experience. Prefers to locate in Florida. Registered in Michigan. PW-330

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Ph.G. Hospital pharmacy experience. Prefers to locate in Maryland. Registered in Maryland. PW-329

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained M. S. in 1961. Two years' hospital pharmacy experience. Prefers to locate in Minnesota. Registered in Minnesota and California. PW-327

CHIEF PHARMACIST—Male, married. B. S. Hospital pharmacy experience. Will locate anywhere. Registered in New Jersey and Pennsylvania. PW-326

STAFF OR ASST. CHIEF PHARMACIST—Female, single. Will obtain B. S. in June 1961. Hospital pharmacy experience. Prefers to locate in the Midwest, West or Northeast. PW-325

STAFF OR ASST. CHIEF PHARMACIST—Female, single. Obtained B. S. in 1960. Hospital pharmacy experience. Will locate anywhere. Registered in Michigan. PW-324

ASST. CHIEF OR CHIEF PHARMACIST—Male, single. Obtained B. S. and M. S. in 1956. Three years' hospital pharmacy experience, and two years teaching experience. Served hospital pharmacy internship. Prefers to locate in the South or Southwest. Registered in Georgia and Tennessee. PW-323

ASST. CHIEF OR CHIEF PHARMACIST—Male, single. Obtained M. S. in 1960. Four years' hospital pharmacy experience. Prefers to locate in California or Missouri. Registered in California and Missouri. PW-322

CHIEF PHARMACIST—Female, single. Obtained B. S. in 1956. Five years' hospital pharmacy experience. Prefers to locate in the East. Registered in Florida and Georgia. PW-320

ASSOC. DIRECTOR OR DIRECTOR OF PHARMACY SERVICE—Male, married. Obtained M. S. in 1960 at University of Michigan. Teaching and hospital pharmacy experience. Served hospital pharmacy internship. Will locate anywhere. Registered in Pennsylvania. PW-319

STAFF OR ASST. CHIEF PHARMACIST—Male, single. Obtained B. S. in 1955. Hospital pharmacy experience. Prefers to locate in the East. Registered in New York, Maine and Indiana. PW-318

ASST. CHIEF OR CHIEF PHARMACIST—Male, married, Obtained B. S. in 1960. Prefers to locate in the Southeast. Registered in Tennessee. PW-317

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained B. S. and presently working for M. S. at University of Maryland. Hospital pharmacy experience. Prefers to locate in the East. Registered in Maryland. PW-315

CHIEF PHARMACIST—Male, single. Obtained B. S. in 1955. Serving hospital pharmacy internship. Hospital pharmacy experience. Registered in Texas. Will locate anywhere. PW-314

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained B. S. in 1954 at University of Cincinnati College of Pharmacy. Three years' hospital pharmacy experience. Prefers to locate in Texas or Hawaii. Registered in Ohio. PW-313

ASST. CHIEF OR CHIEF PHARMACIST—Male, single, Obtained B. S. in 1959 and will obtain M. S. in August at State University of Iowa. Two years' hospital pharmacy experience. Serving hospital pharmacy internship. Prefers to locate in Midwest or West. Registered in Iowa. PW-311

STAFF PHARMACIST—Male, married. Obtained B.S. in 1940 at Brooklyn College of Pharmacy. Will locate anywhere. Registered in New York, Pennsylvania, New Jersey and Florida. PW-307

STAFF PHARMACIST—Male, single. B. S. obtained in 1960 at Texas Southern University. Will locate anywhere. Registered in Louisiana and in the process of being registered in Oklahoma. PW-306

CHIEF PHARMACIST—Male, married. B. S. obtained in 1957 at University of Cincinnati. Four years' hospital pharmacy experience. Prefers to locate in the Midwest. Registered in Kentucky and will soon be registered in Colorado. PW-304

CHIEF PHARMACIST—Male, married. Will obtain M. S. in June of 1961. Serving hospital pharmacy internship. Hospital pharmacy experience. Will locate anywhere. PW-303

STAFF PHARMACIST—Male, married. Obtained B. S. in 1960. Hospital pharmacy experience. Prefers to locate in the West. Registered in Texas. PW-302

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained B. S. in Organic Chemistry in 1941 and B. S. in Pharmacy in 1953. Five years' hospital pharmacy experience. Prefers to locate in Michigan and Colorado. Registered in Michigan. PW-301

STAFF PHARMACIST—Male, married. B. S. obtained at Texas Southern University, Houston in 1960. Will locate anywhere. Registered in Texas. PW-298

ASST. CHIEF OR CHIEF PHARMACIST—Female, single. B. S. obtained at Ohio State University College of Pharmacy in 1954. Five years' hospital pharmacy experience. Prefers to locate in the Midwest or East. Registered in Illinois and Ohio. PW-297

STAFF OR ASST. CHIEF PHARMACIST—Male, married. B. S. obtained in 1952 at Idaho State College. Prefers to locate in California. Registered in Idaho, Utah, Washington, Oregon and California. PW-296

STAFF PHARMACIST—Female, single. B. S. obtained in 1956 at Philadelphia College of Pharmacy and Science. Hospital pharmacy experience. Prefers to locate in the Los Angeles, California area. Registered in Pennsylvania and eligible for registration in California. PW-295

CHIEF PHARMACIST—Male, married. B. S. obtained at the Philadelphia College of Pharmacy and Science in 1951. Nine years' hospital pharmacy experience. Prefers to locate in the North, Midwest or in the West. Registered in Pennsylvania and Delaware. PW-294

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained M. S. at Philadelphia College of Pharmacy. Served hospital pharmacy internship. Three years' hospital pharmacy experience. Prefers to locate in Connecticut. Registered in Connecticut and Pennsylvania. PW-290

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained M. S. at the University of Iowa in 1958. Served hospital pharmacy internship. Military obligations completed. Hospital pharmacy experience. Prefers to locate in the West. Registered in Colorado and Iowa. PW-289

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. B. S. obtained at University of Illinois. Extensive hospital pharmacy experience. Prefers to locate in the East or Midwest. Registered in Illinois. PW-287

STAFF OR ASST. CHIEF PHARMACIST—Male, married. Obtained B. S. in 1954 at Rutgers College of Pharmacy. Hospital pharmacy experience. Prefers to locate in Florida. Registered in Florida, New Jersey and New York. PW-286

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. B. S. received at Purdue University in 1944. Served hospital pharmacy internship. Extensive hospital pharmacy experience. Will locate anywhere. Registered in Indiana, Michigan and Wisconsin. PW-285

STAFF OR ASST. CHIEF PHARMACIST—Male, single. Obtained B. S. in 1959 at the University of Colorado. Completed hospital pharmacy internship at Denver General Hospital in June 1960. Prefers to locate in the West or Midwest. Registered in Colorado. PW-284

ASST. CHIEF OR CHIEF PHARMACIST—Female, married. B. S. obtained in 1954. Six years' hospital pharmacy experience. Prefers to locate in New York, New Mexico, Texas and Louisiana. PW-282

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Received at Ohio State University B. S. in Biology in 1952 and B. S. in Pharmacy in 1955. Five years' hospital pharmacy experience. Willing to locate in the East, North or West. Registered in Ohio. PW-277

ASST. CHIEF OR CHIEF PHARMACIST—Female, single. B. S. obtained in 1956 at University of Wyoming. Working towards M. S. at the University of Maryland. Served hospital pharmacy internship. Hospital pharmacy experience. Prefers to locate in the West. Registered in Wyoming. PW-276

STAFF OR ASST. CHIEF PHARMACIST—Female, married B. S. obtained in 1954 at St. Louis College of Pharmacy. Six years' hospital pharmacy experience. Prefers the Northwestern part of the country, but willing to locate anywhere. Registered in Missouri. PW-275

ASST. CHIEF OR CHIEF PHARMACIST—Male, single. M. S. obtained in 1958 at University of Texas. Served hospital pharmacy internship. Hospital pharmacy experience. Prefers to locate in the Southwest. Registered in Kansas and Texas. PW-270

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. B. S. obtained in 1955 at the University of Nebraska. Five years' hospital pharmacy experience. Prefers to locate in California. Registered in Nebraska and California. PW-269

ASST. CHIEF OR CHIEF PHARMACIST—Female, single. B. S. Degree. Fifteen years' administration and practical experience in hospital pharmacy. Prefers Midwest, particularly Illinois or Wisconsin. Registered in Virginia, Illinois, Wisconsin and Michigan. PW-268

CHIEF PHARMACIST—Male, single. Obtained M. S. is 1954 at University of Tennessee. Served hospital pharmacy internship. Six years' hospital pharmacy experience. Prefers to locate in the Southwest or in Florida. Registered in Connecticut and New York. PW-266

CHIEF PHARMACIST—Male, married. Obtained M. S. in hospital pharmacy at State University of Iowa in June 1959. Served hospital pharmacy internship. Three years' hospital pharmacy experience. Will locate anywhere. Registered in Illinois. PW-264

CHIEF PHARMACIST—Male, married. B. S. Fourteen years' hospital pharmacy experience. Prefers to locate in the East or Midwest. Registered in Pennsylvania and West Virginia. PW-260

ASST. CHIEF PHARMACIST—Male, single. Obtained B. S. in 1956 at Purdue University. Hospital pharmacy experience. Prefers position with administrative and/or teaching duties. Would like to locate in Northeast or Southwest section of country. Registered in Texas. PW-256

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Obtained B. S. in 1954 at South Dakota State College. Two years' hospital pharmacy experience. Will locate anywhere. Registered in South Dakota. PW-247

STAFF PHARMACIST—Male, married. Received B. S. in June 1960 at Philadelphia College of Pharmacy and Science. One year's hospital pharmacy experience. Prefers to locate in Philadelphia. PW-246

DIRECTOR OF PHARMACY SERVICES—Male, single. Received B. S. in 1956 at the University of California. Served hospital pharmacy internship. Four years' hospital pharmacy experience. Registered in California. Prefers to locate in California. PW-237

PHARMACIST—Female, single. M. S. received at University of Maryland in 1951. Served hospital pharmacy internship. Five years' hospital pharmacy experience. Prefers to locate in New Jersey. Registered in Pennsylvania and Missouri. PW-225

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. B. S. received at Detroit Institute of Technology in 1950. Four year's hospital pharmacy experience. Prefers to locate in Michigan. Registered in Michigan. PW-224

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. Received B. S. at Medical College of South Carolina in 1950. Four years' hospital pharmacy experience. Prefers Southeast section of country. Registered in North Carolina and South Carolina. PW-221

STAFF OR CHIEF PHARMACIST—Male, single. B. S. received in 1952 at St. Louis College of Pharmacy. Two years' hospital pharmacy experience. Registered in Missouri. Prefers to locate on the West Coast, particularly California. PW-217

STAFF PHARMACIST—Female, single. B. S. Seven years' hospital pharmacy experience. Southwest seection of country preferred. Registered in Alabama and Georgia. PW-199

ASST. CHIEF OR CHIEF PHARMACIST—Male, married. M. S. obtained in 1956 at Columbia University College of Pharmacy. Hospital experience. Prefers to locate in California. Registered in New York, Michigan, New Jersey and Florida. PW-184

ASST. CHIEF OR CHIEF PHARMACIST—Male. B. S. received in 1954. Desires to locate in Michigan, Ohio and Illinois. Registered in Michigan. PW-177

CHIEF PHARMACIST—Male, married. B. S. Ten years' hospital pharmacy experience. Registered in Mass., Ill., Mo., Ky., Tenn., and Virginia. PW-150

ASST. CHIEF OR CHIEF PHARMACIST—Male, single. Registered in D. C., Ill., Md., and Penna., Graduate University of Pittsburgh in 1953. Experience in research. Prefers North and East. PW-148

CHIEF PHARMACIST—Male, married. Graduate of St. Johns University College of Pharmacy. Extensive experience as chief pharmacist and purchasing agent. Prefers to locate in New York or New Jersey. Registered in New York and New Jersey. PW-144

CHIEF PHARMACIST—Female, single. Registered in Pennsylvania and Ohio. Twelve years' hospital pharmacy experience as a chief pharmacist. Prefers to locate in Penna., and Ohio. PW-111

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